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MAY 22 1923

# Contractors' and Engineers' Monthly

Excavation of Core Trench for Scituate Dam of the New Water-Supply for Providence, R. I.

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VOL. VI. No. 5 CONTRACTORS' & ENGINEERS' MONTHLY MAY, 1923

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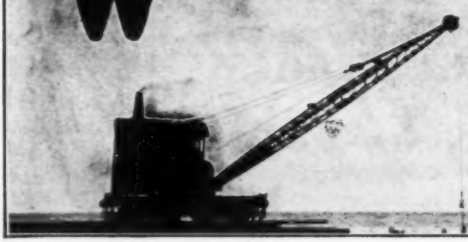

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

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Jeffrey Mfg. Co., Columbus, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
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Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.
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*Pioneer Asphalt Co., Lawrenceville, Ill.
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Barrett Co., New York.
Gulf Refining Co., Pittsburgh, Pa.
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Ky. Rock Asphalt Co., Louisville, Ky.
New Orleans Refining Co., New Orleans, La.
Sinclair Ref. Co., Chicago, Ill.
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Standard Oil Co. of La., New Orleans, La.
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*Connery & Co., Philadelphia, Pa.
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Bacon Co., Edw. R., San Francisco, Cal.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, Ohio.
Hetherington & Berner, Indianapolis, Ind.

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*Equitable Asphalt Maint. Co., Kansas City, Mo.
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*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
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Byers Machine Co., Ravenna, Ohio.
Constr. Mchy. Co., Waterloo, Ia.
Oshkosh Mfg. Co., Oshkosh, Wis.
Parsons Co., Newton, Ia.
Weller Mfg. Co., Chicago, Ill.

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*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Concrete Steel Co., New York.
Electric Welding Co., Pittsburgh, Pa.
Hinman & Co., D. A., Sandwich, Ill.
McKenna Co., Cleveland, Ohio.

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*Truscon Steel Co., Youngstown, Ohio.
Concrete Steel Co., New York.
Universal Form Clamp Co., Chicago, Ill.

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Ames & Co., W., Jersey City, N. J.
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*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Fairfield Engineering Co., Lancaster, Ohio.
Green Engineering Co., E. Chicago, Ind.
Link-Belt Co., Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Weller Mfg. Co., Chicago, Ill.

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**BLASTING POWDER** (See Explosives)

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Casey-Hedges Co., Chattanooga, Tenn.
Chandler & Taylor Co., Indianapolis, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
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Hartley Boiler Works, Montgomery, Ala.
Heine Boiler Co., St. Louis, Mo.
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Valk & Murdoch Co., Charleston, S. C.
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Clark Bros. Bolt Co., Milldale, Conn.
Erie Bolt & Nut Co., Erie, Pa.
Foster Bolt & Nut Mfg. Co., Cleveland, Ohio.
Inland Steel Co., Chicago, Ill.
Lamson & Sessions Co., Cleveland, Ohio.
Maryland Bolt & Forge Co., Baltimore, Md.
Milton Mfg. Co., Milton, Pa.
Neely Nut & Bolt Co., Pittsburgh, Pa.
Oliver Iron & Steel Corp'n, Pittsburgh, Pa.
Pittsburgh Screw & Bolt Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Rhode Island Tool Co., Providence, R. I.
Russell, Bursdall & Ward Co., Port Chester, N. Y.
St. Louis Screw Co., St. Louis, Mo.
Scranton Bolt & Nut Co., Scranton, Pa.
Star Exp. Bolt Co., New York.
Sweet's Steel Co., Williamsport, Pa.

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Hays Mfg. Co., Erie, Pa.
Mueller Mfg. Co., H., Decatur, Ill.
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Ingersoll-Rand Co., New York City

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Berlin Constr. Co., Berlin, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Boston Bridge Works, Boston, Mass.
Central States Bridge Co., Indianapolis, Ind.
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Chesapeake Iron Works, Baltimore, Md.
Chicago Bridge & Iron Works, Chicago, Ill.
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Eastern Bridge & Struc. Co., Worcester, Mass.
Flour City Orn. Iron Co., Minneapolis, Minn.
Fort Pitt Bridge Works, Pittsburgh, Pa.
Ingalls Iron Works Co., Birmingham, Ala.
Inter. Steel & Iron Co., Evansville, Ind.
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Blaw-Knox Co., Pittsburgh, Pa.
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Browning Co., Cleveland, O.
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Hayward Co., New York.
Industrial Works, Bay City, Mich.
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Link-Belt Co., Chicago, Ill.
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Williams Co., G. H., Erie, Pa.

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*Smith Co., T. L., Milwaukee, Wis.
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Browning Co., Cleveland, O.
Hayward Co., New York.
Kiesler Co., J. F., Chicago, Ill.
Lakewood Eng. Co., Cleveland, O.
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Williams Co., G. H., Erie, Pa.

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Carbondale Calcium Co., Carbondale, Pa.

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Marchant Calc. Machine Co., Oakland, Cal.
Monroe Calculating Machine Co., Orange, N. J.

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Economy Baler Co., Ann Arbor, Mich.
Safety Sanitary Rubbish Box Co., Columbus, O
Solar-Sturges Mfg. Co., Chicago, Ill.
Steel Basket Co., Cedar Rapids, Iowa.

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Atlas Car & Mfg. Co., Cleveland, O.
Austin Machinery Corp'n, Toledo, O.
Chase Fdry. & Mfg. Co., Columbus, O.
Easton Car & Constr. Co., New York.
Hunt Co., C. W., W. New Brighton, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Light Ry. Equipment Co., Philadelphia, Pa.
Oliver Mfg. Co., W. J., Knoxville, Tenn.
Stuebner Iron Works, G. L., L. I. City, N. Y.
United Iron Works, Kansas City, Mo.
Weller Mfg. Co., Chicago, Ill.
Whiting Corp'n, Harvey, Ill.

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*Ransome Concrete Mchy. Co., Dunellen, N. J.
*Smith Co., T. L., Milwaukee, Wis.
*Sterling Wheelbarrow Co., Milwaukee, Wis.
Akron Barrow Co., Cleveland, Ohio.
Etnyre & Co., E. D., Oregon, Ill.
Gray Iron Fdry. Co., Reading, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.
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Klauer Mfg. Co., Dubuque, Iowa.
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Sessions Foundry Co., Bristol, Conn.
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**CATCH BASINS** (See Castings, Street and Sewer)

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Mesker & Co., Geo. L., Evansville, Ind.
Milwaukee Corrugating Co., Milwaukee, Wis.
Wheeling Corrugating Co., Wheeling, W. Va.

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Allentown Portland Cement Co., Allentown, Pa.
Alpha Portland Cement Co., Easton, Pa.
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Atlas Portland Cement Co., New York.
Bath Portland Cement Co., Philadelphia, Pa.
Beaver Portland Cement Co., Portland, Ore.
Bessemer Limestone and Cement Co., Youngstown, O.
Bonner Portland Cement Co., Kansas City, Mo.
Canada Cement Co., Ltd., Montreal, Canada.
Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.
Castalia Portland Cement Co., Pittsburgh, Pa.
Clinchfield Portland Cement Corp., Kingsport, Tenn.
Colorado Portland Cement Co., Denver, Colo.
Continental Portland Cement Co., St. Louis, Mo.
Coplay Cement Manufacturing Co., Coplay, Pa.
Cowell Portland Cement Co., San Francisco, Cal.
Crescent Portland Cement Co., Wampum, Pa.
Dewey Portland Cement Co., Kansas City, Mo.
Dexter Portland Cement Co., Nazareth, Pa.
Diamond Portland Cement Co., Cleveland, Ohio.
Dixie Portland Cement Co., Chattanooga, Tenn.
Edison Portland Cement Co., New York.
Fredonia Portland Cement Co., Fredonia, Kans.
Giant Portland Cement Co., Philadelphia, Pa.
Gilmore Portland Cement Corp., Gilmore City, Iowa.
Glens Falls Portland Cement Co., Glens Falls, N. Y.
Golden State Portland Cement Co., Los Angeles, Cal.
Gulf States Portland Cement Co., Demopolis, Ala.
Hawkeye Portland Cement Co., Des Moines, Ia.
Helderberg Cement Co., Albany, N. Y.
Hercules Cement Corp., Philadelphia, Pa.
Indiana Portland Cement Co., Indianapolis, Ind.
International Portland Cement Co., Ltd., Spokane, Wash.
Knickerbocker Portland Cement Co., Inc., New York.
Kosmos Portland Cement Co., Louisville, Ky.
Lawrence Portl'd Cement Co., Northampton, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Portland Cement Co., St. Louis, Mo.
Monarch Cement Co., Humboldt, Kans.
Nazareth Cement Co., Nazareth, Pa.
Newaygo Portland Cement Co., Newaygo, Mich.
Nebraska Cement Co., Denver, Colo.
New Egyptian Portland Cement Co., Fenton, Mich.
New York & New England Cement & Lime Co., New York.
Northwestern States Portland Cement Co., Mason City, Ia.
Ogden Portland Cement Co., Ogden, Utah.
Oklahoma Portland Cement Co., Denver, Colo.
Old Mission Portland Cement Co., San Francisco, Cal.
Olympic Portl'd Cement Co., Ltd., Seattle, Wash.
Oregon Portland Cement Co., Portland, Ore.
Pacific Portland Cement Co., San Francisco, Cal.
Peerless Portland Cement Co., Union City, Mich.
Peninsular Portland Cement Co., Cement City, Mich.
Penn-Allen Cement Co., Allentown, Pa.
Petoskey Portland Cement Co., Petoskey, Mich.
Phœnix Portland Cement Co., Nazareth, Pa.
Portland Cement Co. of Utah, Salt Lake City, Utah.
Pyramid Portland Cement Co., Des Moines, Ia.
Riverside Portl'd Cement Co., Los Angeles, Cal.
San Antonio Portland Cement Co., San Antonio, Tex.
Sandusky Cement Co., Cleveland, Ohio.
Santa Cruz Portland Cement Co., San Francisco, Cal.
Security Cement and Lime Co., Hagerstown, Md.
Signal Mountain Portland Cement Co., Chattanooga, Tenn.
Southern States Portland Cement Co., Rockport, Ga.
Southwest'n Portland Cement Co., El Paso, Tex.
Standard Portland Cement Corp., San Francisco, Calif.
Superior Portland Cement Co., Seattle, Wash.
Texas Portland Cement Co., Dallas, Tex.
Three Forks Portland Cement Co., Denver, Colo.
Tidewater Portland Cement Co., Baltimore, Md.
Trinity Portland Cement Co., Dallas, Tex.
Union Portland Cement Co., Ogden, Utah.
United States Potash Co., Los Angeles, Cal.
U. S. Portland Cement Co., Denver, Colo.
Universal Portland Cement Co., Chicago, Ill.
Vulcanite Portland Cement Co., Philadelphia, Pa.
Wabash Portland Cement Co., Detroit, Mich.
Wellston Iron Furnace Co., Jackson, Ohio.
Western States Portland Cement Co., Independence, Kans.
Whitehall Cement Mfg. Co., Philadelphia, Pa.
Wolverine Portl'd Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Detroit, Mich.

**CEMENT GUNS**

Cement Gun Co., Allentown, Pa.

**CEMENT INSPECTION** (See Inspecting Laboratories)

**CHAINS**

American Chain Co., Inc., Bridgeport, Conn.
Chain Belt Co., Milwaukee, Wis.
Columbus McKinnon Chain Co., Columbus, O.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Niagara Metal Stamp Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

**CHECK VALVES**

*Ludlow Valve Mfg. Co., Troy, N. Y.
Columbian Iron Works, Chattanooga, Tenn.
Lunkenheimer Co., Cincinnati, O.
Mueller Mfg. Co., H., Decatur, Ill.

**CHEMICALS FOR WATER PURIFICATION**

Du Pont de Nemours & Co., E. I., Wilmington, Del.
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.
Mathieson Alkali Works, Inc., New York.
Penna. Salt Mfg. Co., Philadelphia, Pa.

# *Built by "Gar" Wood*

**Wood-Detroit Hydraulic Hoists and Steel Bodies are playing a big part in building thousands of miles of better highway. Far more trucks in this work are Wood-Detroit equipped than with all other power hoists combined.**

WOOD DETROIT

**This universal use, the endorsement of over 90% of the truck makers, and the record of success of the last decade all attest the superiority of this equipment.**

## Wood Hydraulic Hoist and Body Co.

**7924 Riopelle Street, Detroit, Michigan**

**Sales and Service in All Principal Cities**

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Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

**CHIMNEYS, RADIAL BRICK**

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Custodis Chimney Const. Co., Alphons, New York.
Heine Chimney Co., Chicago, Ill.
Heinicke, Inc., H. R., Indianapolis, Ind.
Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.

**CHIMNEYS, STEEL** (See Stacks, Steel)

**CHLORINATORS**

*Wallace & Tiernan Co., Inc., Newark, N. J.

**CHLORINE, LIQUID** (See Liquid Chlorine)

**CHUTES, CONCRETE**

*Ransome Concrete Mchy. Co., Dunellen, N. J.
Akron Barrow Co., Cleveland, Ohio
Insley Mfg. Co. Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

**CLIPS, WIRE ROPE**

American Hoist & Derrick Co., St. Paul, Minn.
Marion Malleable Iron Works, Marion, Ind.
Mockbee & Co., C. M., Cincinnati, O.
Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

**COAL AND ORE CONVEYING MACHINERY**

*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Robins Conv. Belt Co., New York.
Barber-Greene Co., Aurora, Ill.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Brown Hoisting Mchy. Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kon-Wald Co., Buffalo, N. Y.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

**COCKS, CURB AND CORPORATION**

*Union Water Meter Co., Worcester, Mass.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
Mueller Mfg. Co., H., Decatur, Ill.

**COLUMN CLAMPS**

*Sterling Wheelbarrow Co., Milwaukee, Wis.
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Universal Form Clamp Co., Chicago, Ill.

**COMPRESSORS, AIR** (See Air Compressors)

**CONCRETE FLOOR HARDENER**

*Truscon Laboratories, Detroit, Mich.
Anti-Hydro Waterproofing Co., Newark, N. J.
General Chemical Co., New York.
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonneborn Sons, Inc., L., N. Y. "Lapidolith"

**CONCRETE MIXERS**

*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Jaeger Machine Co., Columbus, O.
*Atlas Eng. Co., Milwaukee, Wis.
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
*Smith Co., T. L., Milwaukee, Wis.
Austin Machinery Corp'n, Toledo, O.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Gray Iron Fdry Co., Reading, Pa.
Judy Mfg. Co., Centerville, Ia.
Knickerbocker Co., Jackson, Mich.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Marsh-Capron Co., Chicago, Ill.
Milwaukee Concrete Mixer Co., Milwaukee, Wis.
Oshkosh Mfg. Co., Oshkosh, Wis.
Republic Iron Works, Tecumseh, Mich.
Schramm, Inc., West Chester, Pa.
Standard Scale & Supply Co., Pittsburgh, Pa.
Truckmixer Co., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

**CONCRETE PILING.** (See Piling, Concrete)

**CONCRETE REINFORCEMENT**

*Truscon Steel Co., Youngstown, O.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
National Steel Fabric Co., Pittsburgh, Pa.
Ryerson & Son., J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., New York.
Youngstown Pressed Steel Co., Warren, O.

**CONCRETE ROAD FINISHERS**

*Dunn Road Mach. Co., Conneaut, Ohio.
Lakewood Eng. Co., Cleveland, Ohio

**CONCRETE TOOLS**

*Dallett Co., Thos. H., Philadelphia, Pa.

**CONDENSERS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York.

**CONDUIT RODS**

Bissell Co., F., Toledo, Ohio.
Turbine Sewer Machine Co., Milwaukee, Wis.
Waldo Bros. & Bond Co., Boston, Mass.

**CONDUITS, INTERIOR**

American Circular Loom Co., Boston, Mass.
Central Tube Co., Pittsburgh, Pa.
National Metal Molding Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

**CONDUITS, UNDERGROUND**

American Vitrified Products Co., Akron, Ohio.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Fibre Conduit Co., Orangeburg, N. Y.
Johns-Manville, Inc., New York.
National Fireproofing Co., New York.

**CONTRACTORS' SUPPLY DEALERS**
(See pages 101-116)

**CONTRACTORS' USED EQUIPMENT**

*Haetten Co., J. E., New York.
*Spiro & Co., Maxwell, New York City

**CONVEYORS, BELT**

*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Robins Conv. Belt Co., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Barber-Greene Co., Aurora, Ill.
Chain Belt Co., Milwaukee, Wis.

# Open to Traffic in 10 Days!

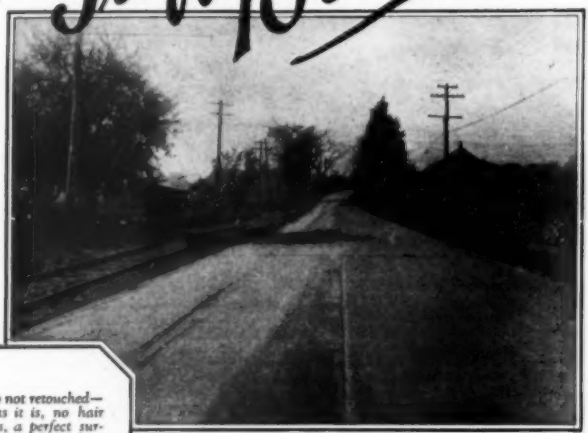

*Photo not retouched—just as it is, no hair cracks, a perfect surface cured by Solvay Calcium Chloride.*

THE concrete on the road pictured above was placed October 5th and 6th and the road was opened to traffic on October 16th!

That shows a real saving of time not only for the contractor, who thus receives his money that much sooner, but for the Highway Engineer who thus is so much sooner enabled to turn to other work, and also there is a real service to the community, which is able to make use of the road so much sooner.

State and County Engineers, wherever Calcium Chloride curing has been used, are unanimous in their commendation. Results are certain with Solvay because it automatically proceeds with the curing. There is no worry concerning daily sprinkling, no expense for inspectors. Once Solvay is applied the curing goes ahead and you quickly have the road in use, a strong perfectly cured concrete highway.

Solvay may be obtained in drums containing 375 lbs. or in the moisture-proof, easy to handle 100-lb. bag, shipped from 50 conveniently located distributing points.

## *For* CONCRETE CURING

## *use* SOLVAY
*Free Running*
**Calcium Chloride**

The Solvay Method is cheaper, quicker, surer, more efficient than the old time covering methods. Let us prove it—write for our latest literature or send us details of your work and our engineers will give you the benefit of their experience without charge. Address

**The SOLVAY PROCESS CO., Syracuse, New York**

Gifford Wood Co., Hudson, N. Y.
Goodyear Tire & Rubber Co., Akron, O.
Imperial Belting Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Standard Conveyor Co., No. St. Paul, Minn.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

**CONVEYORS, BUCKET**

*Atlas Engineering Co., Milwaukee, Wis.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Robins Conv. Belt Co., New York.
Bartlett & Snow Co., C. O., Cleveland, O.
Caldwell & Son, H. W., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford Wood Co., Hudson, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Olson & Co., Sam'l, Chicago, Ill.
Republic Rubber Co., Youngstown, O.
Stephens Adamson Mfg. Co., Aurora, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

**CONVEYORS, GRAVITY**

Standard Conveyor Co., No. St. Paul, Minn.
Mathews Gravity Carrier Co., Ellwood City, Pa.

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*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravena, O.
Davenport Locomotive Works, Davenport, Ia.
Erie Steam Shovel Co., Erie, Pa.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
Thew Shovel Co., Lorain, O.
U. S. Crane Co., Chicago, Ill.

**CRANES, OVERHEAD TRAVELING**

*Pawling & Harnischfeger Co., Milwaukee, Wis.
Alliance Machine Co., Alliance, O.
Chesapeake Iron Wks., Baltimore, Md.
Cleveland Crane & Eng. Co., Kenton, O.
Champion Engineering Co., Kenton, O.
Milwaukee Electric Crane Co., Milwaukee, Wis.
Morgan Engineering Co., Alliance, O.
Northern Eng. Works, Detroit, Mich.
Shaw Crane Works, Muskegon, Mich.
Shepard Elec. Cr. & Hst. Co., Montour Falls, N.Y.
Toledo Crane Co., Bucyrus, O.
Whiting Fdry. & Equip. Co., Harvey, Ill.

**CRANES, WRECKING**

Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Industrial Works, Bay City, Mich.

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American Creosoting Co., New York.
American Creosote Works, Inc., N. Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Colonial Creosoting Co., Inc., Bogalusca, La.
Creosoted Materials Co., New Orleans, La.
Georgia Creosoting Co., Brunswick, Ga.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Granite City, Ill.
Republic Creosoting Co., Indianapolis, Ind.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

**CREOSOTING AND CREOSOTING OILS**

Am. Creosote Wks., Inc., New Orleans, La.
Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

**CRUSHERS AND PULVERIZERS (See Rock Crushers)**

**CULVERTS, METAL**

*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Galion Iron Works & Mfg. Co., Galion, Ohio.
*Good Roads Machinery Co., Kennett Square, Pa.
*Newport Culvert Co., Newport, Ky.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmington, Ala.
Canton Culvert & Silo Co., Canton, O.
Concrete Form Co., Inc., Syracuse, N. Y.
Dee Co., W. E., Chicago, Ill.
Dominion Metal Products Corp., Roanoke, Va.
Florida Metal Products Co., Jacksonville, Fla.
Hardesty Mfg. Co., The R., Denver, Colo.
Klauer Mfg. Co., Dubuque, Ia.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Madison Foundry Co., Cleveland, O.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

**CURB BOXES**

*Clark Co., H. W., Matteon, Ill.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Foundry Mfg. Co., St. Albans, Vt.
Madison Foundry Co., Cleveland, O.
Mueller Mfg. Co., Decatur, Ill.
Thompson-Fleming Co., Inc., Buffalo, N. Y.

**CURB GUARDS, STEEL**

Godwin Co., W. S., Baltimore, Md.

**CURB, STEEL PROTECTED**

*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., New York.
National Steel Fabric Co., Pittsburgh, Pa.
Steel Protected Concrete Co., Philadelphia, Pa.

**CUTTERS, PIPE, HAND**

Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., New Haven, Conn.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp'n., Greenfield, Mass.
Oswego Tool Co., Oswego, N. Y.
Reed Mfg. Co., Erie, Pa.
Walworth Mfg. Co., Boston, Mass.

**CUTTERS, ROD AND WIRE**

*Koehring Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carolus Mfg. Co., Sterling, Ill.
Carpenter & Co., Geo. B., Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Worthington Pump & Mchy. Corp., New York.

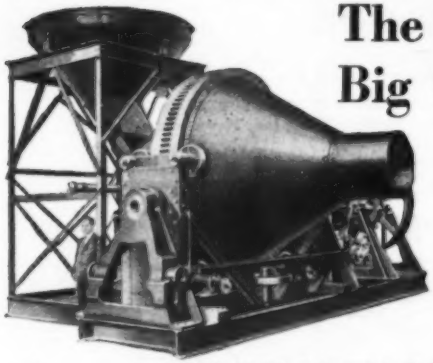
**CUTTING AND WELDING APPARATUS**

Macleod Co., Cincinnati, O.
Milburn Co., Alexander, Baltimore, Md.
Prest-O-Lite Co., Inc., New York.

**DERRICKS, GUY AND STIFF-LEG**

American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., Ravenna, O.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Horton Co., John T., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Lincoln Iron Works, Rutland, Vt.
National Hoisting Engine Co., Harrison, N. J.
Saagen Derrick Co., Chicago, Ill.
Smith, Whitcomb & Cook Co., Barrie, Vt.
Superior Iron Works, Superior, Wis.

# The Little Brother of the Big Smith Tilting Mixers



*No. 112-S Smith Mixer; Largest in the World —112 cu. ft. of Mixed Concrete per Batch.*

*Smith 375 Half-Bag Tilting Mixer—Two-Wheel Model RW-1—Pressed Steel Wheels Fitted with Clincher Rims for Ford 30x3½ Pneumatic Tires.*

*Smith 375 Half-Bag Tilting Mixer with Feed Chute Four-Wheel Model SW-1—Discharge Side—Tilting Lever Locks in Discharge Position. Drum returns Automatically when lever is released.*

*Smith 375 Half-Bag Tilting Mixer—Four-Wheel Model SW-1 Charging Side with Feed Chute and Low Charging Platform.*

Now and again, some new invention or development is brought out which, because of its importance, causes an unusual amount of comment. Now comes the new Smith 375, a Half-Bag Tilting Mixer, which is just such an invention. The mixed batch capacity is 3¾ cu. ft., which is a full half bag (1-3-6 mix) with materials containing the usual 40% voids.

## The Fame of Smith Tilting Mixers

This little mixer is the same famous Smith Tilting Mixer which has been the quality standard of the mixer industry for twenty-three years—the same duo-cone tilting drum, same central gear-ring and roller track, same independent tilting frame, same tilting discharge. It's the same Smith Tilting Mixer that mixed the concrete for the Miami Conservancy District, General Motors Office Building, Fisher Body Plant, U. S. Government Dam at Muscle Shoals, New York Aqueduct and dozens of other world famous projects. It's the same general design and quality as the largest mixer in the world shown above.

## A Mixer of Highest Quality

In spite of its small size and low price the Smith 375 is the best-made machine in the entire Smith line. The inspection is most rigid and the parts are all made to the closest micrometer tolerances of any machine we build.

## Real Portability at Last

Light weight (1100 pounds) plus real speed trailer trucks—the last word in a portable machine. Two steel bronze-bushed wheels equipped for Ford tires, with an extension hauling stub and a pivoted front supporting stub. Hitch it on behind your Ford and you are ready to go.

## Quantity Production — Lowers Price

Price was hardly considered; Smith Mixer quality, speed and durability were the prime considerations. But large quantity production, combined with Smith manufacturing facilities and Smith invention and design have made possible a low price which makes the Smith No. 375 the biggest mixer value ever offered to the trade.

***Write for Descriptive Leaflet***

## *The* T. L. SMITH COMPANY

**1020 - 32nd Street, Milwaukee, Wis.**

**New York Office and Warehouse: 50 Church Street.**
**Western Warehouse: Oakland, Calif.**
**Chicago Office: Old Colony Bldg.**

# SMITH 375 MIXERS

**DERRICKS, PIPE LAYING**
Austin Machinery Corp'n, Toledo, O.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Mueller Mfg. Co., H., Decatur, Ill.

**DERRICKS, REVOLVING**
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.

**DERRICKS, STEEL**
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill

**DERRICKS, STEEL PORTABLE**
Austin Machinery Corp'n, Toledo, O.
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill

**DERRICKS, TRAVELING**
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Nat'l Hoisting Engine Co., Harrison, N. J.
Orton & Steinbrenner Co., Chicago, Ill.

**DIESEL ENGINES.** (See Engines, Oil)

**DISTRIBUTING PLANTS, CONCRETE**
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Archer Iron Works, Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

**DITCHING MACHINES** (See Excavators, Ditch and Trench)

**DIVIDING PLATES (ROAD)**
*Godwin Co., W. S., Baltimore, Md.

**DOORS, METAL**
Central Metal Products Corp., Canton, Ohio.
Dahlstrom Metallic Door Co., Jamestown, N. Y.
Friedrich Co., E. H., Holyoke, Mass.
Lawton-Stephens Co., Brooklyn, N. Y.
McFarland Co., J. C., La Porte, Ind.
Penn Metal Co., Boston, Mass.
Siester & Theamacher Co., Cleveland, Ohio.
Sykes Co., Chicago, Ill.
Thorp Fire Proof Door Co., Minneapolis, Minn.

**DOORS AND SHUTTERS, STEEL ROLLING**
Cornell Iron Works, New York.
Kinnear Mfg. Co., Columbus, O.
Variety Mfg. Co., Chicago, Ill.
Wilson Corp., J. G., New York.

**DRAFTING MACHINES**
Universal Drafting Machine Co., Cleveland, O.

**DREDGES**
American Steel Dredge Co., Fort Wayne, Ind.
Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Ellicott Machine Corp'n., Baltimore, Md.
Erie Steam Shovel Co., Erie, Pa.
Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Marion Steam Shovel Co., Marion, O.
Osgood Co., The, Marion, O.
Stockton Iron Works, Stockton, Cal.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

**DREDGES, DIPPER**
*Fairbanks Steam Shovel Co., Marion, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

**DREDGES, HYDRAULIC**
*Fairbanks Steam Shovel Co., Marion, O.
Bucyrus Co., South Milwaukee, Wis.
Ellicott Mach. Corp., Baltimore, Md.
Marion Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

**DREDGING PUMPS AND ACCESSORIES**
Erie Pump & Engine Wks., Medina, N. Y.

**DRILLS, AIR**
*Dallett Co., Thos. H., Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

**DRILLS, CORE**
*McKiernan-Terry Drill Co., New York.
Dobbins Core Drill Co., Inc., New York.
Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.
Sullivan Mach'y Co., Chicago, Ill.

**DRILLS, HAMMERS (PNEUMATIC)**
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, O.
Ingersoll-Rand Co., New York.
Natl. Elec. Mfg. Co., Pittsburgh, Pa.
Sullivan Machinery Co., Chicago, Ill.

**DRILLS, ROCK**
*Dallett Co., Thos. H., Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Natl. Elec. Mfg. Co., Pittsburgh, Pa.
Sullivan Machinery Co., Chicago, Ill.
Wood Drill Works, Paterson, N. J.

**DRILLS FOR WELLS AND BLAST HOLES** (See Well Drilling Machinery)

**DRUMS, HOLDING**
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

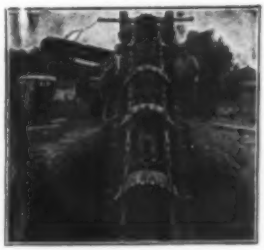
**DRYERS, ASPHALT AND CEMENT**
Allis-Chalmers Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Ruggles-Coles Eng. Co., New York.
Variety Iron & Steel Works, Cleveland, O

**DRYERS, SAND AND GRAVEL**
*Littleford Bros., Cincinnati, Ohio.

**DUMP BODIES FOR MOTOR TRUCKS**
*Heil Company, Milwaukee, Wis.

# When the Trench Runs Close to Trees or Poles

You keep right **a goin'** with your Buckeye even when you're working in crowded quarters, with poles or trees close to the trench. You shift the conveyor to the clear side—your Buckeye keeps right on **a diggin'**. A mighty handy feature to have when you **need** it—and a regular life saver if you tackle much work in crowded quarters.



***One Machine Instead of Two—***

when you've a Buckeye and the new Rotary Auxiliary Cutter. That's the kind of economy a contractor can **appreciate.** The C-20 cuts 40 to 76 in. wide—the C-15 from 24 to 60, and the C-10 from 24 to 44. Adjustments made quickly. Simple, too. Just two extra shafts—one on each side of the boom—with cutting teeth mounted on them.

## The Buckeye Traction Ditcher Co., Findlay, O.

*Manufacturers of Trench Excavators (both Wheel and Chain-and-Bucket Types), Pipe-Line Trench Excavators, Tile and Open Ditchers, Back-Fillers, Pipe Screwing Machines, Curb Diggers and Clay Diggers.*

**Branch Sales Offices:**

| | |
|---|---|
| New York | Chicago |
| San Francisco | Los Angeles |
| Tulsa, Okla. | Denver |
| Miami, Fla. | Mason City, Iowa |
| Chatham, Ont. | Salt Lake City |
| Winnipeg, Man. | Milwaukee |

Buckeye

*International Motor Co., New York.
*Littleford Bros., Cincinnati, O.
*Wood Hydr. Hoist & Body Co., Detroit, Mich.
American Truck Body Co., Inc., Martinville, Va.
Archer Iron Works, Chicago, Ill.
Auto Truck Steel Body Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Columbia Wagon & Body Co., Columbia, Pa.
Horizontal Hydraulic Hoist Co., Detroit, Mich.
Jennings Automatic Dump Body, Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill
Pechstein Iron Works, Keokuk, Iowa.
Simplex Mfg. Co., Conneautville, Pa.
Van Dorn Iron Wks., Cleveland, Ohio.

**DUMP CARTS AND WAGONS, HORSE DRAWN**

*Austin Western Road Mchy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Acme Road Machinery Co., Frankfort, N. Y.
Acme Wagon Co., Emigsville, Pa.
Austin Mfg. Co., Chicago, Ill.
Columbia Wagon & Body Co., Columbia, Pa.
Eagle Wagon Works, Auburn, N. Y.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Stroud & Co., Omaha, Nebr.
Tiffin Wagon Co., Tiffin, Ohio.
Watson Products Corp., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

**DUST LAYING AND ROAD BINDER MATERIALS**

*Dow Chemical Co., Midland, Mich.
*Semet-Solvay Co., Solvay, N. Y.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Co., New York.
Barrett Co., New York.
Carbondale Calcium Co., Carbondale, Pa.
Dustoline for Roads Co., Summit, N. J.

**DYNAMITE** (See Explosives)

**EJECTORS, SEWAGE**

Pacific Flush Tank Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

**ELECTRIC GENERATORS AND MOTORS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Ideal Elec. & Mfg. Co., Mansfield, O.
Lincoln Electric Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Western Electric Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

**ELECTRIC LAMPS**

General Electric Co., Schenectady, N. Y.
Westinghouse Lamp Co., New York.

**ELECTRIC LIGHTING PLANTS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Climax Engineering Co., Clinton, Ia.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Western Electric Co., New York.

**ELECTRIC SUPPLIES, METERS, ETC.**

Bissell Co., F., Toledo, Ohio.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

**ELECTRIC TRANSFORMERS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

**ELECTRIC WIRES AND CABLES.** (See "Wire and Cable")

**ELEVATORS, BUCKET**

Atlas Eng. Co., Milwaukee, Wis.
*Austin Western Road Machy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Littleford Bros., Cincinnati, Ohio.
*Robins Conv. Belt Co., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

**ELEVATORS, PASSENGER, FREIGHT, ETC.**

Albro-Clem Elevator Co., Philadelphia, Pa.
Amer. Elevator & Mach. Co., Louisville, Ky.
Bay State Elevator Co., Springfield, Mass.
Haughton Elev. & Mach. Co., Toledo, Ohio.
Kaestner & Hecht Co., Chicago, Ill.
Llewellyn Iron Works, Los Angeles, Cal.
Montgomery Elevator Co., Moline, Ill.
Otis Elevator Co., New York.
Ridgeway & Son Co., C., Coatesville, Pa.
See Elec. Elevator Co., A. B., New York.
Speidel, J. G., Reading, Pa.
Warner Elevator Mfg. Co., Cincinnati, O.
Warsaw Elevator Co., Warsaw, N. Y.

**ENGINES, GAS AND GASOLINE**

*Domestic Engine & Pump Co., Shippensburg, Pa.
*Hercules Corpn., Evansville, Ind.
*Holt Mfg. Co., Peoria, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
Climax Engineering Co., Clinton, Ia.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, Ohio.
Fuller & Johnson Mfg. Co., Madison, Wis.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
Nelson Bros. Co., Saginaw, Mich.
"New-Way" Motor Co., Lansing, Mich.
Novo Engine Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Wellman-Seaver-Morgan Co., Cleveland, O.
Worthington Pump & Mchy. Corp., New York

**ENGINES, HIGH DUTY WATER-WORKS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Worthington Pump & Mchy. Corp., New York

**ENGINES, OIL**

DIESEL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Busch-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
Dodge Sales & Eng. Co., Mishawaka, Ind.
Fulton Iron Works Co., St. Louis, Mo.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
McIntosh & Seymour Corp., Auburn, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
Western Machy. Co., Los Angeles, Cal.

SEMI-DIESEL

Anderson Fdry. & Mach. Co., Anderson, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Buckeye Machinery Co., Lima, O.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
De La Vergne Machine Co., New York.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, O.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.
Muncie Oil Eng. Co., Muncie, Ind.
Nordberg Mfg. Co., Milwaukee, Wis.
St. Mary's Oil Eng. Co., St. Charles, Mo.
Stover Mfg. & Engine Co., Freeport, Ill.
Taylor Machine Co., Cleveland, O.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

**ENGINES, PUMPING**

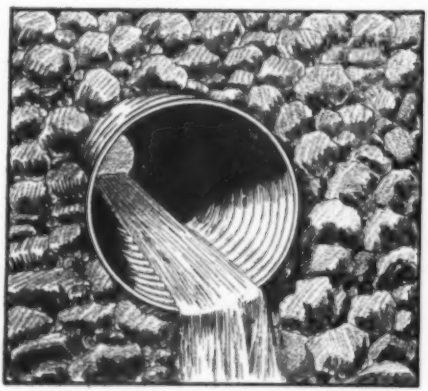
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Gas Engine Co., Kansas City, Mo.
American Well Works, Aurora, Ill.
Climax Engineering Co., Clinton, Ia.

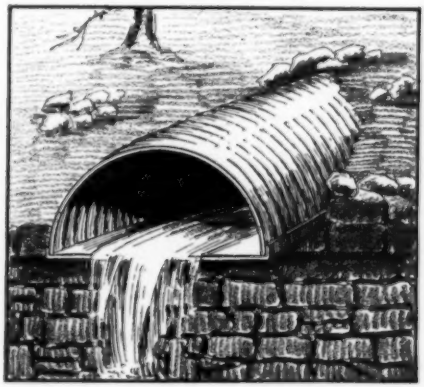
# GENUINE OPEN-HEARTH IRON

## RUST-RESISTING

# CULVERTS

The high quality of the material used and the adaptability of Newport round and half-round types of corrugated culvert pipe, to the needs of the road builders, make NEWPORT GENUINE OPEN-HEARTH IRON corrugated metal culverts the standard for road work everywhere. The iron has had the impurities eliminated to an extent not usually reached in any other grade of pure iron. This makes the culverts rust-resisting and the corrugations give them strength, thus assuring the road master or engineer that he is buying a high-grade culvert.





Newport culvert pipes of round, riveted, full-circle construction, are the strongest corrugated metal culverts manufactured. They are easily installed and last a lifetime. The half-round flat-bottom culvert pipe is particularly adapted to city use. It is made in 2-foot lengths so that whenever a pipe becomes clogged it is easy to dig down and lift the section immediately above where the clogged condition exists, clean out and replace it with no necessity of interfering with traffic or the expense of digging up the whole pipe.

## NEWPORT CULVERT CO.

**542 West Tenth St., Newport, Kentucky**

Dayton-Dowd Co., Quincy, Ill.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Enterprise Mchy. Co., Minneapolis, Minn.
Midwest Engine Co., Indianapolis, Ind.
Nordberg Mfg. Co., Milwaukee, Wis.
United Iron Works, Inc., Kansas City, Mo.
Weinman Pump Mfg. Co., Columbus, O.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Worthington Pump & Mchy. Corp., New York.

**ENGINES, STEAM**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dake Engine Co., Grand Haven, Mich.
Erie-Ball Engine Co., Pittsburgh, Pa.
Erie Pump & Engine Co., Medina, N. Y.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

**EXCAVATING MACHINERY.** (See Names Under Excavators, also Steam Shovels)

**EXCAVATORS, CABLEWAY**

Bucyrus Co., South Milwaukee, Wis.
Lidgerwood Mfg. Co., New York.

**EXCAVATORS, DITCH AND TRENCH**

*Buckeye Traction Ditcher Co., Findlay, O.
*Fairbanks Steam Shovel Co., Marion, O.
*Keystone Driller Co., Beaver Falls, Pa.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Byers Machine Co., Ravenna, Ohio.
Ball Engine Co., Erie, Pa.
Bucyrus Co., South Milwaukee, Wis.
Clyde Iron Works Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Hayward Co., The, New York City.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

**EXCAVATORS, DRAG-LINE**

*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Sauerman Bros., Chicago, Ill.
*Smith Co., T. L., Milwaukee, Wis.
Austin Machinery Corp'n, Toledo, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Gade Excavator Works, C. L., Iowa Falls, Iowa
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

**EXPANDED METAL**

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Northwestern Expanded Metal Co., Chicago, Ill.
Youngstown Pressed Steel, Co., Warren, O.

**EXPANSION JOINT MATERIAL**

*Barber Asphalt Co., Philadelphia, Pa.
*Carey Co., Philip, Cincinnati, Ohio.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Servicised Products Co., Chicago, Ill.
*Texas Company, New York.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.
Barrett Co., New York.

**EXPLOSIVES**

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Hercules Powder Co., Wilmington, Del.

**FENCING**

Adrian Wire Fence Co., Adrian, Mich.
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Nitselman Bros., Muncie, Ind.
Michigan Wire Fence Co., Adrian, Mich.
Page Steel & Wire Co., Bridgeport, Conn.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Iron Works Co., Cincinnati, Ohio.
Texas Cyclone Fence Co., Fort Worth, Tex.
Wickwire Spencer Steel Corp., New York.

**FILING EQUIPMENT, STEEL**

Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works, Cleveland, O.

**FILTERS, OIL**

Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

**FILTERS, WATER**

American Water Softener Co., Philadelphia, Pa
Graver Corporation, E. Chicago, Ind.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewel Filtr. Co., Nutley, N. J.
Norwood Engineering Co., Florence, Mass.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

**FIRE ALARM SYSTEMS**

Gamewell Fire Alarm Tel. Co., Newton Upper Falls, Mass.

**FIRE ALARM SIRENS**

Erick Elec. Siren Co., St. Paul, Minn.
Federal Sign System, Chicago, Ill.
Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Col.
Interstate Machine Prod. Co., Rochester, N. Y
Sireno Co., Stapleton, N. Y.
Union Water Meter Co., Worcester, Mass.

**FIRE APPARATUS, MOTOR**

*International Motor Co., New York.
Ahrens-Fox Fire Engine Co., Cincinnati, O.
American-La France Fire Eng. Co., Elmira, N. Y.
Brockway Motor Fire App. Co., Cortlandt, N. Y.
Northern Fire Apparatus Co., Minneapolis, Minn.
Foamite-Childs Corp., Utica, N. Y.
Pirsch & Sons Co., Peter, Kenosha, Wis.
Prospect Mfg. Co., Prospect, O.
Seagrave Co., Columbus, O.
Stutz Fire Engine Co., Indianapolis, Ind.
Waterous Fire Engine Co., St. Paul, Minn.

**FIRE EXTINGUISHERS, CHEMICAL**

American-La France Fire Eng. Co., Elmira, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite-Childs Co., Utica N. Y.
Pyrene Mfg. Co., Newark, N. J.

**FIREPROOF BUILDING MATERIAL**

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Delaware Clay Products Co., Pittsburgh, Pa.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.
Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
Youngstown Pressed Steel, Co., Warren, O.

**FIRST AID EQUIPMENT**

American-La France Fire Eng. Co., Elmira, N. Y.

# Dribble, D-r-i-b-b-l-e -or TILT and POUR?

THE quickest, easiest way to discharge a batch of concrete is **to tilt and pour.** That's **the Jaeger way**—far more efficient than the halting, dribbling discharge of non-tilting mixers. Tilt and Pour means more concrete laid in a shorter time with less labor.

See that your next mixer is the **tilting-drum type.** And then, for **maximum speed and thoroughness in mixing,** choose the Jaeger. Its mixing action is the most perfect known. Drum is so shaped and blades so designed and placed that the concrete is hurled in three directions—back, forward and toward the center, thoroughly mixed in 40 seconds. Discharged in 10 seconds! And the mixer reloaded in 10 seconds! One minute to the batch!

The Jaeger mixing action and tilting drum are the two biggest features ever built into a mixer. That's why the Jaeger is the world's biggest-selling mixer. Speedy. Light. Simple. 18 models. For complete information, get the Jaeger catalog. Write today.

It is infringement to make, use or sell a patented invention without authority under the patent. Our patents have been sustained by the United States Courts in six different instances. Purchasers of our Mixers are protected.

Jaeger
A MIX A MINUTE

**THE JAEGER MACHINE COMPANY**

701 Dublin Avenue Columbus, Ohio

**FLEXIBLE JOINTS**
*Central Foundry Co., New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
United Lead Company, New York.

**FLOORING, COMPOSITION**
*Barber Asphalt Co., Philadelphia, Pa.
Am. Mason Safety Tread Co., Lowell, Mass.
Barrett Co., New York.
Johns-Manville Co., H. W., New York.
Marine Decking & Supply Co., Phila., Pa.
Muller, Franklyn R., & Co., Waukegan, Ill.

**FLOORS, WOOD BLOCK**
*Servicised Products Co., Chicago, Ill.
Barrett Co., New York.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Sou. Wood Preserving Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

**FLUSH TANKS**
Pacific Flush Tank Co., Chicago, Ill.

**FLUSHERS, STREET.** (See Street Flushers and Sprinklers.)

**FORGES**
Buffalo Forge Co., Buffalo, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.

**FORM CLAMPS**
Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind.
Universal Form Clamp Co., Chicago, Ill.

**FORMS, CONCRETE**
*Connery & Co., Philadelphia, Pa.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Concrete Form Co., Inc., Syracuse, N. Y.
Hetzel Steel Form & Iron Co., The, Warren, O.
Hydraulic Steelcraft Co., Cleveland, O.
Lakewood Eng. Co., Cleveland, Ohio.
Metal Forms Corp., Milwaukee, Wis.

**FOUNTAINS, DRINKING**
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, Jas. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Mott Iron Wks., J. L., New York.
Murdock Mfg. & Supply Co., Cincinnati, Ohio.
Puro San. Dr. Ftn. Co., Haydenville, Mass.
Randle-Spence Mfg. Co., Milwaukee, Wis.
Stewart Iron Works Co., Cincinnati, O.
Taylor Co., Halsey W., Warren, O.
Twentieth Century Brass Wks., Belleville, Ill.

**FURNITURE AND FILES, STEEL**
Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works Co., Cleveland, O.

**GARBAGE CANS.** (See Cans)

**GARBAGE DISPOSAL**
Balmer Corp., New York.
Bartlett, C. O. & Snow Co., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
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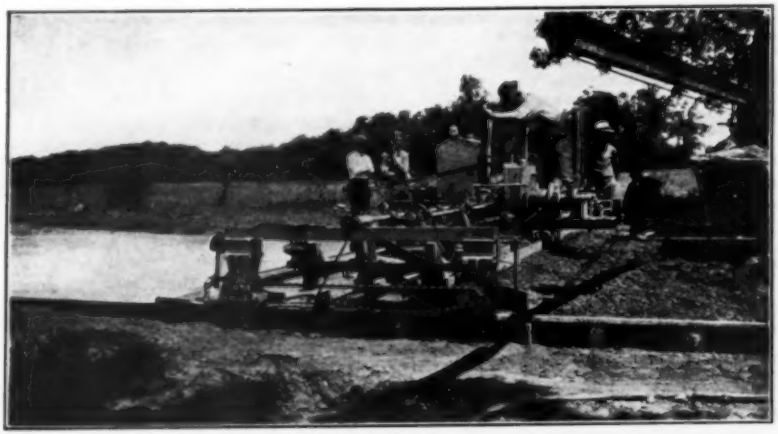

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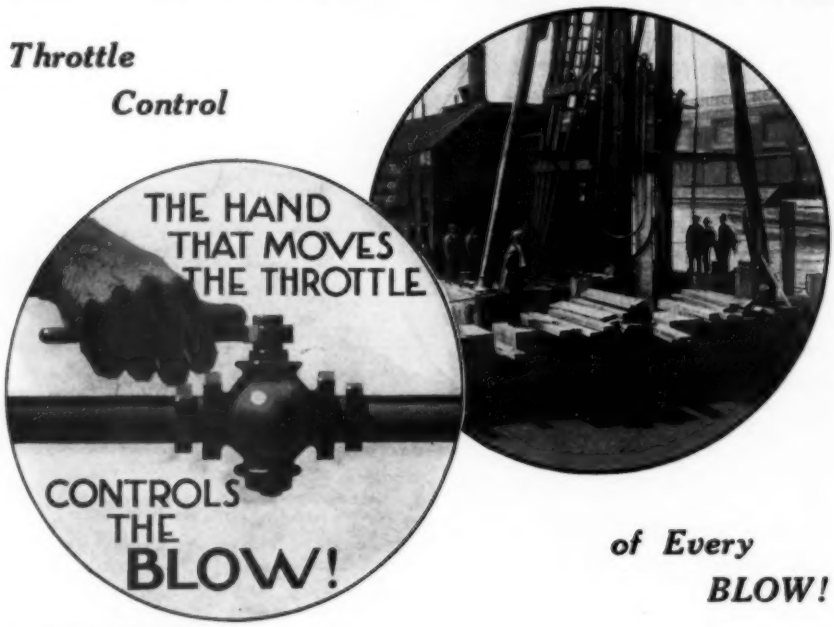
# For Concrete Pile Driving

*Throttle Control*

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Duplex Truck Co., Lansing, Mich.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Gramm Bernstein Motor Truck Co., Lima, O.
Indiana Truck Corp'n., Marion, Ind.
International Harvester Co., Chicago, Ill.
Kelly Springfield Motor Truck Co., Springfield, O.
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Tr. Co., Binghamton, N.Y.
Nash Motors Co., Kenosha, Wis.
Oshkosh Truck Sales & Finance Corp., Oshkosh, Wis.
Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Rowe Motor Mfg. Co., Lancaster, Pa.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Corp'n., Buffalo, N. Y.
Tiffin Wagon Co., Tiffin, O.
Titan Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
Ward LaFrance Truck Co., Elmira, N. Y.
Wilson Co., J. C., Detroit, Mich.
White Co., Cleveland, Ohio.

**MOULDS, CONCRETE**

Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.

**OAKUM**

Wall Rope Works, Beverly, N J.

**OILS, ROAD**

*Barber Asphalt Co., Philadelphia, Pa.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Company, New York.
Atlantic Refining & Asphalt Corp'n, Philadelphia
Barrett Co., New York.
Headley Good Roads Co., Philadelphia, Pa.
Pierce Oil Corp., New York.
Sinclair Refining Co., Chicago, Ill.
Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.) Newark, N. J.
U. S. Asphalt Refining Co., New York.

**OXY-ACETYLENE APPARATUS**

Oxweld Acetylene Co., Newark, N. J.

**OXYGEN**

Linde Air Products Co., New York.

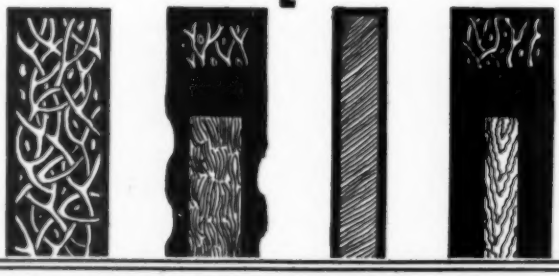
**PACKING, WATER PIPE**

*Union Water Meter Co., Worcester, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Company, New York.

**PAINTS, METAL PROTECTION**

*Barber Asphalt Co., Philadelphia, Pa.
*Dixon Crucible Co., Jos., Jersey City, N. J.
*Truscon Laboratories, Detroit, Mich.
Acme White Ld. & Col. Works, Detroit, Mich.
Barrett Co., New York.

# Servicised Expansion Joints



## MONITORS OF THE ROAD

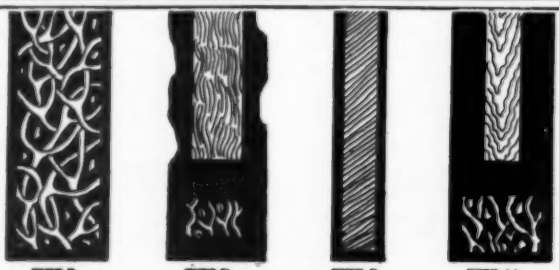
Old principles of expansion joint provide fillers of solid asphaltic content or impregnated fibre and asphalt in an elastic mass. ¶ The fundamental purpose of the filler is to re-occupy the space left by two contracting slabs. ¶ Solid asphaltic or impregnated fibrous materials contract, concrete slabs likewise contract on cooling. ¶ Three contracting bodies cannot occupy the same space as when expanded. Servicised Joints *expand* when the concrete slabs contract. ¶ This is the key to a permanent waterproof joint; a correct answer to the problem of expansion between two contracting bodies. Unimpregnated cellular fibrous matter in Servicised Joints brings about this re-expansion after compression is relieved.

**Trapped Under Compression:** The print to the right is an example of oozing under compression. Due to the hard asphalt surfacing over the concrete base, the traffic could not carry the surplus away because it was locked in between the asphalt surfacing and base. The force was great enough, however, to form bulges in the hard asphalt surface.

*Write Us About Your Expansion Joint Problems*

**A Bituminous and Impregnated Fibre or Elastic Mass:** No better proof of indiscriminate oozing. No better illustration of the need of expansion joint of the proper kind. The action in this instance resembles that of paste in a tube being squeezed with one side open. Action of this kind causes tremendous waste, without resulting in good. Servicised Joints will prevent this.

**Servicised Products Co.**
First National Bank Bldg.
CHICAGO



TYPE B — 75% Bitumen, 25% Cellular Fibre

TYPE D — Self-Expanding Non-Rotting

TYPE C — Felt Cement—Coated Slabs—Sidewalk Joint

TYPE AA — 3/16 Veneer Core

*Four Types of Servicised Expansion Joints in Which the Oozing Tendency Is Controlled*

## Servicise the Crevice and Save the Road

Berry Bros., Detroit, Mich.
Carey Co., Philip, Cincinnati, Ohio.
Cook Paint & Varnish Co., Kansas City, Mo.
Detroit Graphite Co., Detroit, Mich.
Detroit White Lead Wks., Detroit, Mich.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Minwax Co., New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Semet-Solvay Co., Syracuse, N. Y.
Sherwin-Williams Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York.
Tock Bros., New York.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

**PAPERS, BLUE PRINT AND BROWN PRINT**

Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

**PAPER, BUILDING, ROOFING, ETC.**

*Barber Asphalt Co., Philadelphia, Pa.
*Carey Co., Philip, Cincinnati, Ohio.
Barrett Co., New York.
Bird & Son, Inc., E. Walpole, Mass.
Brown Co., Portland, Me.
Hydrex Asphalt Products Corp., New York.
Johns-Manville, Inc., New York.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.

**PARK BENCHES**

Art Concrete Works, Pasadena, Calif.
Bausman Mfg. Co., Bausman, Pa.
Dow Co., Louisville, Ky.
Mott Iron Wks., J. L., New York.
Stewart Iron Works, Cincinnati, Ohio.

**PAVING AND ROAD ROLLERS (See Road and Paving Rollers)**

**PAVING BLOCKS, CREOSOTED WOOD**

American Creosote Wks., Inc., New Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Compressed Wood Preserving Co., Cincinnati, O.
Creosoted Materials Co., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Wyckoff Pipe & Creosoting Co., New York.

**PAVING BRICK**

Alton Brick Co., Alton, Ill.
Barr Clay Co., Streator, Ill.
Binghamton Brick Co., Binghamton, N. Y.
Burton Townsend Co., Zanesville, O.
Flint Brick Co., Des Moines, Ia.
Hydraulic Press Brick Co., St. Louis, Mo.
McAvoy Vit. Brick Co., Philadelphia, Pa.
Mack Mfg. Co., Wheeling, W. Va.
Mayer Brick Co., C. P., Bridgeville, Pa.
Medal Paving Brick Co., Cleveland, O.
Metropolitan Paving Brick Co., Canton, O.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Kas.
Poston Paving Brick Co., Crawfordsville, Ind.
Purington Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Sterling Brick Co., Olean, N. Y.
Thurber Brick Co., Thurber, Texas.
Veedersburg Paver Co., Veedersburg, Ind.

**PAVING MACHINERY. (See Road and Paving Machinery)**

**PAVING GUARDS, STEEL**

Godwin Co., W. S., Baltimore, Md.
International Steel Tie Co., Cleveand, O.

**PAVING MATERIALS (See "Asphalt," "Paving Brick," "Granite Block," etc.)**

**PAVING MIXERS. (See Concrete Mixers)**

**PAVING TOOLS**

*Barber Asphalt Co., Philadelphia, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Littleford Bros. Co., Cincinnati, O.
*Warren Bros. Co., Boston, Mass.
Anderson Tool & Sup. Co., W. H., Detroit, Mich.
Cummer & Sons Co., F. D., Cleveland, O.
Union Iron Works, Hoboken, N. J.

**PERFORATED METALS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.

**PICKS**

Hubbard Co., Pittsburgh, Pa.
Iron City Tool Works, Pittsburgh, Pa.
Klein-Logan Co., Pittsburgh, Pa.
Verona Tool Works, Verona, Pa.
Warren Tool & Forge Co., Warren, O.
Warwood Tool Co., Wheeling, W. Va.
Wyoming Shovel Wks., Wyoming, Pa.

**PILE DRIVERS**

*McKiernan-Terry Drill Co., New York.
Browning Co., Cleveland, O.
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
Lidgerwood Manufacturing Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
McMyler Interstate Co., Cleveland, O.
Union Iron Works, Hoboken, N. J.

**PILE HAMMERS, STEAM**

*McKiernan-Terry Drill Co., New York.
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
National Hoisting Eng. Co., Harrison, N. J.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Chicago, Ill.

**PILING, CONCRETE**

MacArthur Concrete Pile & Foundation Co., N Y.
Raymond Concrete Pile Co., New York.

**PILING, INTERLOCKING STEEL**

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

**PIPE, CAST IRON**

*Central Foundry Co., New York.
*U. S. Cast Iron Pipe & Fdy. Co., Burlington, N.J.
American Cast Iron Pipe Co., Birmingham, Ala.
Clow & Sons, J. B., Chicago, Ill.
Donaldson Iron Co., Emaus, Pa.
Fox & Co., John, New York.
Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
National Cast Iron Pipe Co., Birmingham, Ala.
Warren Fdry. & Machine Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

**PIPE, CULVERT (See Culverts)**

**PIPE, LEAD**

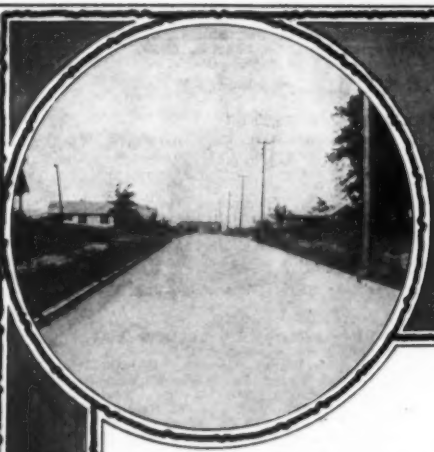
United Lead Company, New York

**PIPE, REINFORCED CONCRETE**

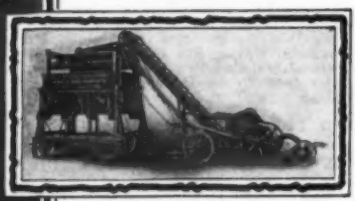
Concrete Products Co., Pittsburgh, Pa.
Core Joint Concrete Pipe Co., Baltimore, Md.
Independent Concrete Pipe Co., Indianapolis Ind.
Lock Joint Pipe Co., E. Orange, N. J.
Massey Concrete Products Corp'n, Chicago, Il

**PIPE, RIVETED STEEL**

*Connery & Co., Inc., Philadelphia, Pa.
*Littleford Bros. Cincinnati, Ohio.
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Canton Culvert & Silo Co., Canton, O.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
East Jersey Pipe Co., New York.
Hammond Iron Works, Warren, Pa.
Hardesty Mfg. Co., R., Denver, Col.
Honhorst Co., Jos., Cincinnati, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa
Tippet & Wood, Phillipsburg, N. J.
Welter Mfg. Co., Chicago, Ill.

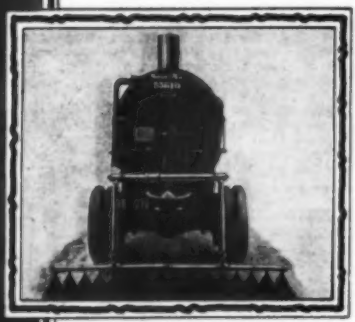


**Thousands of road makers look to us to supply the machinery to make roads as shown in the other circle. We will welcome the opportunity of serving you.**



NO. 4 CHAMPION STEEL ROCK CRUSHER, Mounted, with Elevator, Screen and Portable Stone Bin.

We furnish a complete line of Road Building Machinery. Six different sizes of Road Graders, Portable and Stationary Rock Crushers, Elevators, Screens, Conveyors, Bins, Oiling Machinery, Heating Kettles, Road Drags and Culvert Pipe. If you are looking for high grade machinery and genuine service we would like to hear from you.



CHAMPION HEATING DISTRIBUTOR. For applying all grades of bituminous binders.

MONARCH STEAM ROAD ROLLER, with Scarifier attached. Made in 10 and 12 ton sizes.

*The*
**GOOD ROADS MACHINERY Co**
INC.
**KENNETT SQUARE, PA.**

ATLANTA GA.
PORTLAND ORE.
SAN FRANCISCO
AND
LOS ANGELES CAL.

**PIPE, SPIRAL RIVETED**

Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

**PIPE STEEL**

East Jersey Pipe Co., New York.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Steel & Tube Co. of Am., Chicago, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

**PIPE, WOOD**

American Wood Pipe Co., Tacoma, Wash.
Continental Pipe Mfg. Co., Seattle, Wash.
Michigan Pipe Co., Bay City, Mich.
Pacific Tank & Pipe Co., San Francisco, Cal.
Redwood Mfrs. Co., San Francisco, Cal.
Standard Wood Pipe Co., Williamsport, Pa.
Wyckoff & Son Co., A., Elmira, N. Y.

**PIPE, WROUGHT IRON**

Byers Co., A. M., Pittsburgh, Pa.
Reading Iron Co., Reading, Pa.

**PIPE BENDING MACHINES**

Amer. Pipe Bending Mach. Co., Boston, Mass.
Walworth Mfg. Co., Boston, Mass.

**PIPE COVERING**

**AIRCELL**

*Carey Co., Philip, Cincinnati, Ohio.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.
Nat'l Asbestos Co., Jersey City, N. J.
Norristown Mag. & Asb. Co., Norristown, Pa.
Sall Mt. Co., Chicago, Ill.
Watson Co., H. F., Erie, Pa.

**85 PER CENT MAGNESIA**

*Carey Co., Philip, Cincinnati, Ohio.
Ehret Magnesia Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.

**WOOD**

Continental Pipe Mfg. Co., Seattle, Wn.
Redwood Mfrs. Co., San Francisco, Cal.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

**PIPE CUTTERS.** (See Cutters, Pipe, Hand.)

**PIPE FITTINGS**

*Central Foundry Co., New York.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
American C. I. Pipe Co., Birmingham, Ala.
Builders Iron Fdry, Providence, R. I.
Clow & Sons, J. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Reading Steel Casting Co., Bridgeport, Conn.
Warren Fdry. & Mach. Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

**PIPE HANDLING MACHINERY**

Mueller Mfg. Co., H., Decatur, Ill.
Taylor Portable Steel Derrick Co., Chicago, Ill.

**PIPE JOINT COMPOUND.** (Sewer)

*Carey Co., Philip, Cincinnati, Ohio.
*Waring-Underwood Co., Philadelphia, Pa.
G. K. Sales Co., Macungie, Pa.
Leadite Company, Inc., Philadelphia, Pa.
Pacific Flush Tank Co., Chicago, Ill.
Ruberoid Co., New York.

**PIPE JOINT MATERIAL.** (Cast Iron)

Lead-Hydro-Tite Co., Boston, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Co., New York.

**PLAYGROUND APPARATUS**

American Playground Device Co., Anderson, Ind
Eureka Mfg. Co., Sandusky, O.
Everwear Mfg. Co., Springfield, O.
George, Howard, Philadelphia, Pa.
Hill Standard Co., Anderson, Ind.
Medart Mfg. Co., Fred., St. Louis, Mo.
Spalding & Bros., A. G., Chicopee, Mass.

**PLOWS, CONTRACTORS**

*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.
*Holt Mfg. Co., Peoria, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Steel Scraper Co., Sidney, O.
Avery Co., Peoria, Ill.
Deere & Co., Moline, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y
International Harvester Co., Chicago, Ill.
Moline Plow Co., Rock Island, Ill.
Oliver Chilled Plow Works, South Bend, Ind.
Sidney Steel Scraper Co., Sidney, O.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.
Wiard Plow Co., Batavia, N. Y.

**PLUMBING SUPPLIES**

Clow & Sons, J. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Glauber Brass Mfg. Co., Cleveland, O.
Mott Iron Wks., J. L., New York
Mueller Mfg. Co., H., Decatur, Ill.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
United Brass Mfg. Co., Cleveland, O.
Walworth Mfg. Co., Boston, Mass.

**POLES, STEEL STRUCTURAL**

Blaw-Knox Co., Pittsburgh, Pa.
Electric Railway Equipment Co., Cincinnati, O.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa

**PORTABLE BUILDINGS**

*Littleford Bros., Cincinnati, Ohio.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Milwaukee Corrugating Co., Milwaukee, Wis
Pruden Co., C. D., Baltimore, Md.

**PORTABLE STEEL DERRICKS.** (See Derricks, Steel Portable.)

**PORTLAND CEMENT.** (See Cement.)

**POWDER.** (See Explosives.)

**PUMPS, AIR LIFT**

Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

**PUMPS, BOILER FEED**

Advance Pump & Compr. Co., Battle Creek, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Steam Pump Co., Battle Creek, Mich.
Aurora Pump & Mfg. Co., Aurora, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York.
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Northern Fire Apparatus Co., Minneapolis, Minn.
Scranton Pump Co., Scranton, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Vogt Bros. Mfg. Co., Louisville, Ky.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, O.
Yeomans Bros. Co., Chicago, Ill.

**PUMPS, CENTRIFUGAL**

*Domestic Engine & Pump Co., Shippensburg, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Steam Pump Works, A. S., New York.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.

# BEST TRACTORS

## "most economical"

"We have two BEST 'Thirty' TRACTORS and two of the 'Sixties.' I find the BESTS the *most economical* that I have ever used for road maintenance as well as for construction work. I use ours for all kinds of road work and am widening lots of narrow roads at a very small cost," says a user* of BEST TRACTORS.

* Name of this user will gladly be sent on request.

Investigate BEST TRACTORS among the owners in your vicinity. Write for a list of them.

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St. Louis, Mo.

30 Church St.
New York City

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Erie Pump & Engine Works, Medina, N. Y.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
Manistee Iron Wks., Manistee, Mich.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Schramm, Inc., West Chester, Pa.
United Iron Works, Kansas City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mchy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

**PUMPS, CONTRACTORS'**

*Domestic Engine & Pump Co., Shippensburg, Pa.
*Smith Co., T. L., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Cameron Steam Pump Works, A. S., New York.
Carter Co., Ralph B., New York.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Ia.
Dayton-Dowd Co., Quincy, Ill.
Deming Co., Salem, Ohio.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
LeCourtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., Ashland, O.
Northern Fire App. Co., Minneapolis, Minn.
Nove Engine Co., Lansing, Mich.
Pulsometer Steam Pump Co., New York.
Schramm, Inc., West Chester, Pa.
Standard Scale & Supply Co., Pittsburgh, Pa.
Van Nouhuys Machine Wks., Albany, N. Y.
Waldo Bros. & Bond Co., Boston, Mass.

**PUMPS, DEEP WELL**

*Clark Co., H. W., Matteon, Ill.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
Aldrich Pump Co., Allentown, Pa.
American Well Works, Aurora, Ill.
Cameron Steam Pump Works, A. S., New York.
Cook, Inc., A. D., Lawrenceburg, Ind.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Layne & Bowler Co., Memphis, Tenn.
Midwest Engine Co., Indianapolis, Ind.
Myers & Bro. Co., F. E., Ashland, O.
Nordberg Mfg. Co., Milwaukee, Wis.
United Iron Works, Kansas City, Mo.
Weber Subterranean Pump Co., New York.

**PUMPS, DREDGING**

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Wks., A. S., New York.
Erie Pump & Engine Co., Medina, N. Y.
Morris Machine Works, Baldwinsville, N. Y.
Rumsey Pump Co., Ltd., Seneca Falls, N. Y.
Wood & Co., R. D., Philadelphia, Pa.
Worthington Pump & Mchy. Corp., New York.

**PUMPS, GASOLINE AND OIL**

*Kinney Mfg. Co., Boston, Mass.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Northern Fire App. Co., Minneapolis, Minn.
Wayne Tank & Pump Co., Fort Wayne, Ind.
Worthington Pump & Mach. Corp., New York.

**PUMPS, POWER**

*Domestic Engine & Pump Co., Shippensburg, Pa.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
Alamo Iron Works, San Antonio, Tex.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Steam Pump Co., Battle Creek, Mich
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
Lawrence Machine Co., Lawrence, Mass.
Lea-Courtenay Co., Newark, N. J.
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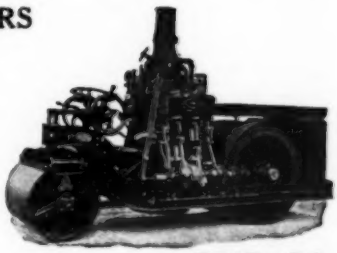

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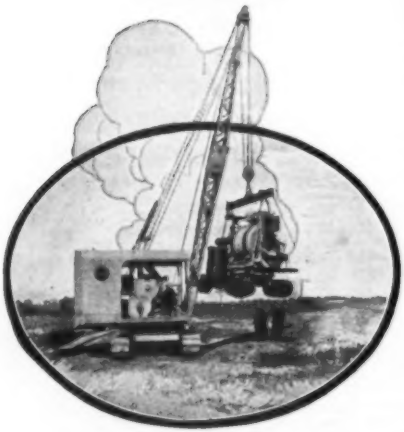

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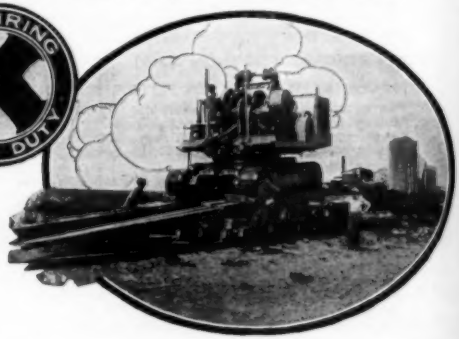

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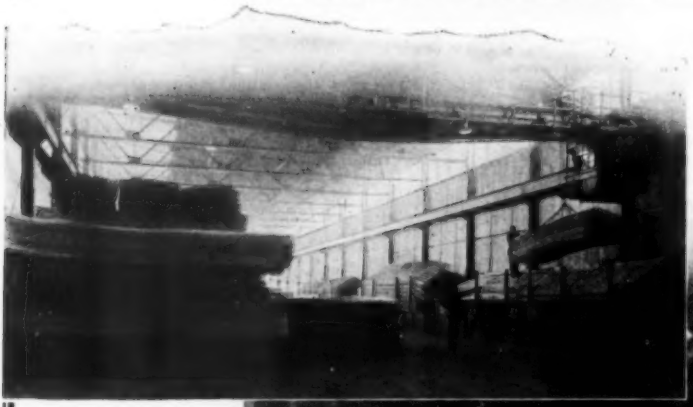

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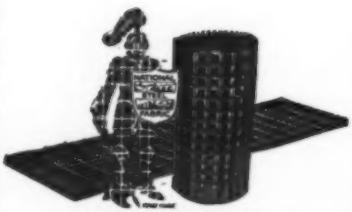

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|---|---|---|---|---|---|---|---|
| | Spacing | Gauge | Area | Spacing | Gauge | Area | |
| BF 88 | 4 | 8 | .062 | 12 | 8 | .021 | 29.6 |
| BF 77 | 4 | 7 | .074 | 12 | 7 | .025 | 35.4 |
| BF 66 | 4 | 6 | .087 | 12 | 6 | .029 | 41.6 |
| BF 55 | 4 | 5 | .101 | 12 | 5 | .034 | 48.4 |
| CF 77 | 6 | 7 | .049 | 12 | 7 | .025 | 27.0 |
| CF 66 | 6 | 6 | .058 | 12 | 6 | .029 | 31.8 |
| CF 55 | 6 | 5 | .067 | 12 | 5 | .034 | 37.0 |
| CF 44 | 6 | 4 | .080 | 12 | 4 | .040 | 43.8 |
| CF 33 | 6 | 3 | .093 | 12 | 3 | .047 | 51.0 |
| CF 00 | 6 | 0 | .148 | 12 | 0 | .069 | 65.3 |
| CC 88 | 6 | 8 | .041 | 6 | 8 | .041 | 30.0 |
| CC 77 | 6 | 7 | .049 | 6 | 7 | .049 | 35.7 |
| CC 66 | 6 | 6 | .058 | 6 | 6 | .058 | 42.0 |
| CC 55 | 6 | 5 | .067 | 6 | 5 | .067 | 48.8 |
| CC 44 | 6 | 4 | .080 | 6 | 4 | .080 | 57.8 |

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J. T. Tractor Co., Cleveland, O.
Owensboro Ditcher & Grader Co., Owensboro, Ky.

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Deming Co., The, Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Fitzhenry-Guptill Co., Boston, Mass.

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*Burch Plow Works Co., Crestline, O.

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*Heil Co., The, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn
Chicago Bridge & Iron Works, Chicago, Ill.
Honhorst Co., Jos., Cincinnati, O.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Walsh & Weidner Boiler Co., Chattanooga, Tenn

**STEAM SHOVELS.** (See Shovels, Steam)

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Caldwell Co., W. E., Louisville, Ky.
Chattanooga Blr. & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Lancaster Iron Wks., Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

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De Laval Steam Turbine Co., Trenton, N. J.
Ingersoll-Rand Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

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*Heil Co., The, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Bethlehem Steel Co., Bethlehem, Pa.
Biggs Boiler Wks., Akron, O.
Birmingham Steel Corp., Birmingham, Ala.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Graver Corporation, E. Chicago, Ind.
Heltzel Steel Form & Iron Co., Warren, O.
Hendrick Mfg. Co., Carbondale, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
McClintic-Marshall Co., Pittsburgh, Pa.
Pennsylvania Bridge Co., Beaver Falls, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Jersey City, N. J.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

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Automatic Furnace Co., Dayton, Ohio.
Babcock & Wilcox Co., New York
Combustion Engine Corp., New York
Detroit Stoker Co., Detroit, Mich.
Laclede-Christy Clay Prod. Co., St. Louis, Mo.
Murphy Iron Works, Detroit, Mich.
Sanford Riley Stoker Co., Worcester, Mass.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

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Durlach Can & Iron Works, Brooklyn, N. Y.
Tarrant Mfg. Co., Saratoga Springs, N. Y.

**STREET FLUSHERS AND SPRINKLERS**
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*General Motors Truck Co., Pontiac, Mich.
*Heil Co., The, Milwaukee, Wis.
*International Motor Co., New York.
*Municipal Supply Co., South Bend, Ind.
Autocar Co., Ardmore, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Federal Motor Truck Co., Detroit, Mich.
Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Tiffin Wagon Co., Tiffin, O.
White Co., Cleveland, O.

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Electric Railway Equipment Co., Cincinnati, O.
General Electric Co., Schenectady, N. Y.
King Mfg. Co., Chicago, Ill.
Massey Concrete Products Co., Chicago, Ill.
Mott Iron Wks., J. L., New York
Union Metal Mfg. Co., Canton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

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*Good Roads Mach. Co., Kennett Square, Pa.
*Universal Road Machinery Co., Kingston, N. Y.
Elgin Sales Corp'n, New York.
Springfield Motor Sweeper Co., Springfield, O.

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Clyde Iron Works, Duluth, Minn.
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Wagner Elec. Mfg. Co., St. Louis, Mo.
Westinghouse Elec. & Mfg.Co.,E. Pittsburgh, Pa.

**TABLES AND BOARDS, DRAWING.** (See Drawing Materials.)

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Construction Mach'y Co., Waterloo, Ia.
Ingersoll-Rand Co., New York

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*Littleford Bros., Cincinnati, O.
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Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Dover Boiler Works, New York.
Fouts Co., C. C., Middletown, O.
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Honhorst Co., Jos., Cincinnati, Ohio.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
United Iron Works, Kansas City, Mo.
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Wayne Tank & Pump Co., Ft. Wayne, Ind.

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Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
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Clark Trucktractor Co., Chicago, Ill.
Dayton-Dowd Co., Quincy, Ill.
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Four Wheel Drive Auto Co., Clintonville, Wis.
Hart-Parr Co., Charles City, Iowa.
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Little Giant Co., Mankato, Minn.
Moline Plow Co., Rock Island, Ill.
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White Company, The, Cleveland, O.

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Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n., Canastota, N. Y.

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Kuhlman Electric Co., Bay City, Mich.
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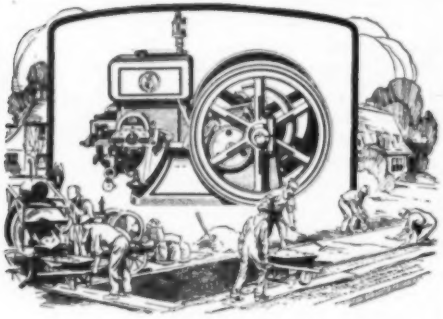

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Lunkenheimer Co., Cincinnati, O.
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Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Mueller Mfg. Co., H., Decatur, Ill.
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MacAndrews & Forbes Co., New York, N. Y.
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Upson Co., The, Lockport, N. Y.
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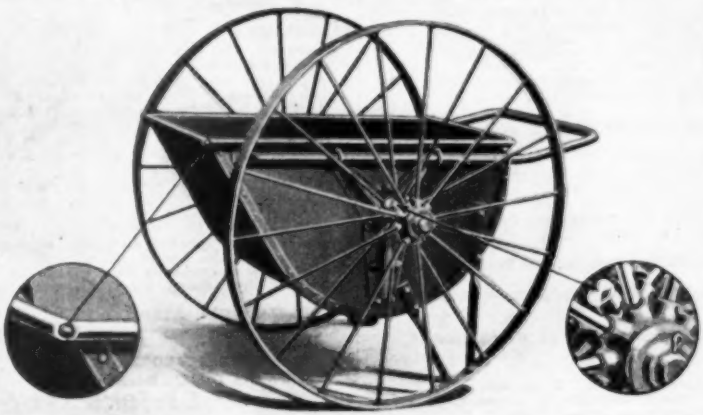

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42" wheels equipped with grease cups. 1½"x9" cold rolled steel axles. Heavy malleable axle brackets, flanged to cover practically the entire side of the tray.

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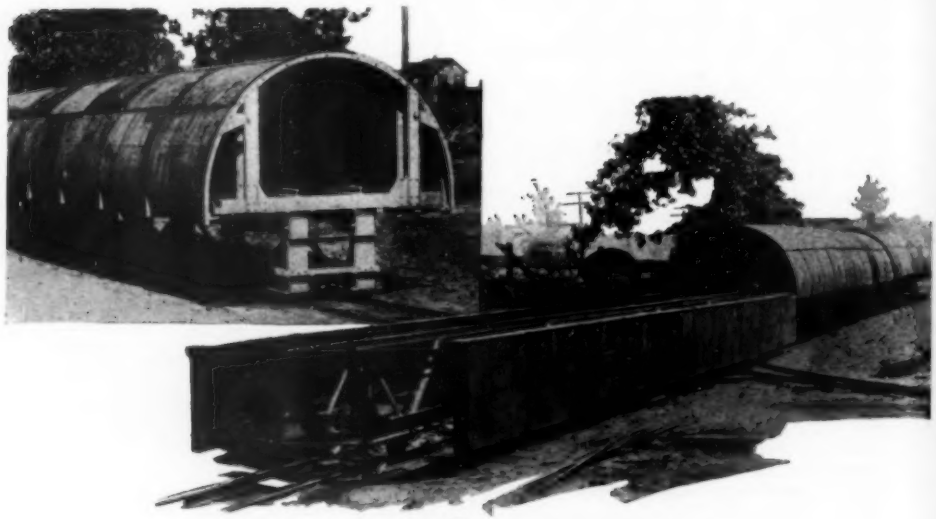

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# Methods and Machinery Used in the Construction of the Scituate Dam of the New Providence Water-Supply

By George A. Griffin
Assistant Engineer, Providence Water Supply Board

IN connection with the development of a new water-supply for the city of Providence there is at present under construction one of the largest dams in this country to be built entirely of earth and by ordinary embankment methods. The main contract for the dam was let to Winston & Company, Inc., of Kingston, N. Y., in May, 1921, and work has been in progress since that time, being about one-third completed and fully up to schedule. It is expected to be completed in 1925. The dam and its appurtenant dikes will impound the water from a drainage area of 92.8 square miles of the Pawtuxet River, thus forming a reservoir of 36,900,000,000 gallons and flooding an area of 3,600 acres.

The dam proper will be 3,200 feet in length, with a maximum height of 178 feet above bedrock, and a thickness of 640 feet at its base. The foundation at its deepest part is 78 feet

**GENERAL VIEW OF THE EXCAVATION FOR THE SCITUATE DAM OF THE PROVIDENCE WATER-SUPPLY, SHOWING THE LAST STAGE OF THE TRACK SYSTEM FOR EXCAVATION**

**The conduit is seen carrying the river in the background, and the tall tower of the cableway is shown on the up-stream side of the coffer-dam at the right**

below the surface of the ground. Imperviousness will be secured by a central core of selected soil starting from a thin concrete blanket covering the bed-rock foundation, the core extending with a width of 77 feet up to within 86 feet of the flow line of the reservoir, then tapering to about 15 feet in width at the top of the core, which is 5 to 7 feet above the flow line, the top of the dam being 9 feet higher.

The soil core of the dam will contain 500,000 cubic yards, and the material comprising the rest of the embankment will contain about 1,900,000 cubic yards of sand, gravel and boulders, exclusive of riprap and soil dressing and of the quantity in the adjoining dike. This latter is to be of similar construction, but is stretched out for a length of 4,000 feet with an average height of 15 feet.

The soil for the core is obtained from open and wooded areas to be flooded, extending upstream for about 2 miles, with small quantities stripped from the site of the work. The remaining embankment of sand and gravel will be obtained principally from borrow-pits located about one-half mile above the dam.

The most interesting and difficult feature of the construction is the excavation of the portion of the core trench crossing the old river bed and the deep rock valley beneath it, a cut in porous gravel and sand some 1,200 feet in length and 78 feet deep at its lowest point, with the Pawtuxet River flowing in its new channel within about 500 feet from the top of the cut at its widest and deepest part, and passing through a concrete conduit at the westerly side of this portion of the trench. To protect this cut during construction, there are coffer-dams about 30 feet high up-stream and 13 feet high down-stream, located so as to form part of the main embankment. These were partially built when the work was commenced, and their completion was the first operation under the main contract for the dam.

The handling of these large quantities of earth called for the use of extensive and up-to-date equipment and machinery of all types, efficient organization, and, above all, a careful planning of the methods and order of doing the various parts of the work: from the engineer's standpoint in order to secure the completion of the work within the desired time; and from the contractor's in order to do this at the minimum cost. To do the latter at a time of high labor cost such as has prevailed for the last few years, the intensive use of machinery for all possible operations was imperative.

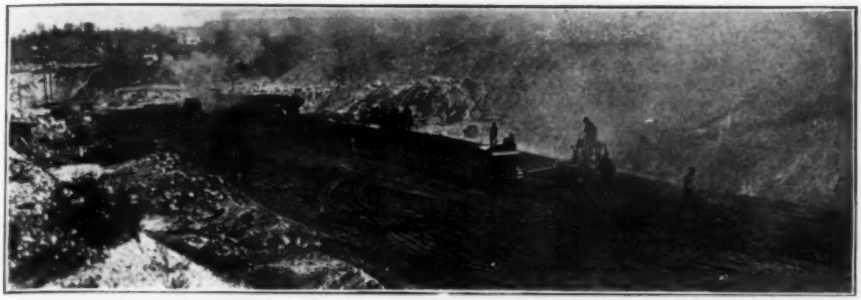
### Construction Camp

The site of the work is about 2.3 miles from the nearest railroad and the nearest settlement of any size. The procuring of supplies and equipment and provisions for housing the labor force were naturally the first undertakings of the contractor.

A fairly flat area of about 20 acres on city property about one-half mile south of the dam was chosen as a site for a camp, and the erection of the usual bunk houses, cottages, offices, stables and store was started. At present there are about 86 buildings comprising this camp, which is supplied with running water, electric lights and the Kaustine system of sanitation with cesspools for house and stable drainage and an incinerator for garbage. A thoroughly equipped hospital with attendants is provided at the camp. Practically the entire labor force,

**CORE TRENCH EXCAVATION, SHOWING THE LOWEST STEAM SHOVEL OPERATION AT ABOUT ELEVATION 135**

**The dragline excavator digging the sump, and the track system at the top of the coffer-dam, 95 feet above the bottom, are both shown in this illustration**



**CONSTRUCTING SOIL CORE WITH INDUSTRIAL TRAIN AND WITH A GRADING MACHINE HAULED BY A HOLT TRACTOR**

**The pervious fill of gravel and sand may be seen at the left**

averaging about 300 men during the past year, has lived at this camp.

For the transportation of supplies and equipment the contractor built a standard-gage single-track railroad from the N. Y. N. H. & H. R. R. at Jackson, a distance of about 2.3 miles to the dam. The right of way for the road is on leased land for about 1.8 miles, the remainder on land of the city of Providence. The terminus of the line is near the east end of the dam, with a spur track to a coal shute up-stream from the dam, easily accessible to the road and to the narrow-gage railroad line running up the valley. Equipment for the railroad consists of one 50-ton, 6-wheel American locomotive, four 34-foot flat cars, three of 60,000-pound capacity, and one of 80,000 pounds, and one 12-foot flat car.

The construction of this road required about 6 weeks; it was ready for use in August, 1921, after which all equipment, coal, cement, etc., shipped by rail was delivered at the site of the work without rehandling. There have been 661 cars of material delivered by this railroad up to January, 1923.

Electric current is brought to the dam by a 23,000-volt line built by the contractor and connecting with the high-tension line of the local power company about 1 mile below the dam. The current is stepped down to 110 volts for lighting and to 550 volts for power purposes such as pumping, operating machine shop, sawmill, etc.

### The Dam and Core Trench

A brief description of the layout of the dam and core trench will make clear the operations described later. The dam runs in a general east-and-west direction, abutting on rocky slopes at each end. Crossing the site about two-fifths of the distance from the west end is a concrete conduit through which the river was diverted under a previous contract from its old bed some 600 feet to the east. This conduit is on rock at about elevation 190, which is a few feet below the general elevation of the ground surface to the east on both sides of the river bed. The rock to the west is comparatively flat, whereas to the east it dips down to elevation 122 at the bottom of the deep cut 700 feet away, rising again on a fairly uniform slope to the top of the knoll forming the east abutment of the dam, about 1,100 feet farther.

Excavation of the westerly core trench was comparatively simple because of its elevation. About 500 feet of this had been excavated under a previous contract and partially refilled, so that this area and the adjacent ground surface up- and down-stream furnished a site for the disposal in final position of the first material excavated in the easterly portion.

The first work on the dam consisted of stripping soil and silt from the site of the deep cut and adjacent areas under the future embankment. This soil varied from about a foot depth on the higher parts to several feet on the lower and wetter places and in the old river bed. The soil suitable for the core of the dam was segregated in storage piles, and the silt and remaining soil were disposed of elsewhere. Horse-drawn scrapers and steam shovels were used for this work, the material being carted in three-hitch bottom-dump wagons drawn by mules. The greater part of the teaming on the work is done by these teams with negro drivers. This combination is well adapted to the type of work and has been found economical and efficient. The shovels used for this were a No. 20 Marion with a 1¼-yard bucket and a No. 14 Bucyrus caterpillar traction with a ¾-yard bucket.

Preliminary to the excavation of the core trench in the deep cut was the lowering of the ground water, which normally stands only a few feet below the surface. Pumping was begun in June, 1921, from a test shaft 300 feet east of the conduit, and continued until October, when the excavation reached the bottom of this shaft. This shaft was 17½ feet deep and 8 by 8 feet at the bottom. Pumping was done by two 4-inch Cameron centrifugal pumps. Soon after, excavation was begun by derrick and skips for a sheeted sump 18½ by 36 feet located near the up-stream edge of the deep cut through fine sand to coarse

underlying strata shown by the borings. After driving sheeting about 35 feet, excavation was discontinued with the bottom about 20 feet below the surface, because the running in of fine sand made a continuation practically impossible by ordinary methods and because it was found that the water could be satisfactorily handled by open sumps.

Pumping from the sheeted sump was first carried on by two 4-inch pulsometers supplied with steam by steam rollers, and later by a No. 6 Cameron electric pump.

The location and maintenance of sumps was one of the controlling factors in the progress of the excavation. The stratification of the sand and gravel was very variable, and although there was considerable fine sand, it was generally found in pockets. Location of the sumps so as generally to avoid these pockets and penetrate the coarse material was the end sought. In the location of sumps, the preliminary borings proved an invaluable aid to the contractor; his adoption of the dragline excavator for digging sumps was the principal factor in their successful maintenance. These excavators were No. 30-B Bucyrus caterpillar traction steam shovels equipped and operated as draglines with 40-foot booms and ¾-yard buckets. Two were used throughout the greater part of the excavation to grade tracks, dig sumps and drainage ditches, and at the bottom of the trench to complete the excavation at the lowest levels.

The first open sump was started by one of the draglines on the down-stream side of the core trench a short distance to the west of the test shaft and before the water-level in this shaft reached the bottom. Pumping started with a 4-inch pulsometer, which was soon replaced by a No. 6 Cameron electric pump. This sump was lowered down the slope of the cut as excavation progressed, until it was replaced by a deeper one, excavated over what was expected to be the lowest point of the foundation. Another open sump was carried down the up-stream slope, and thereafter all the water from the cut was led through ditches into these sumps, from which it was pumped by a battery of electric centrifugal pumps having a combined capacity of about 9 million gallons a day against a 90-foot head. There were in all five No. 6 Cameron D. S. Volute pumps direct-connected to G. E. motors, four 60-horsepower and one 75-horse-power, each pump being rated at 1,035 gallons per minute. The quantity of water increased from about 3 million gallons a day at the end of 1921, with the bottom of the cut about 35 feet below the ground surface, to a maximum of 6.1 million gallons a day during the week of August 5, when the lowest point of the excavation was reached coincident with a heavy rainfall. During this time the pumps averaged 79 pump hours daily.

Pumping from the core trench is a lump sum item of the contract, the payment being made in accordance with the lowering of the water and with the refilling of the trench to specified elevations. The lump sum method of payment furnishes an incentive to rapid work, although it is of course considerable of a gamble for a bidder.

Following the stripping operations, two Marion No. 20 steam shovels equipped with 1¼-yard buckets started at opposite ends of the cut, loading the material into bottom-dump wagons. The first material was used in the two coffer-dams before-mentioned and in grading down-stream for the cableway tower. On the arrival of heavier equipment, consisting of No. 70 Bucyrus shovels with 2½-yard buckets, the smaller shovels were transferred to the lighter excavation on the west of the conduit.

The general method thereafter was to excavate from one end to the other with large steam shovels paralleling each other on opposite slopes of the cut. The earth was carried from loading tracks to main-line tracks operating with a system of switchbacks to final position in the dam or to storage banks. All except a few thousand yards was handled this way, the remainder being excavated by draglines and either rehandled by steam shovels or directly by the cableway and skips. The laying of 3-foot-gage construction track preceded the use of the big shovels. Special attention was given to the location of switchbacks so as to limit the grades and length of haul and to keep to a minimum the necessary relocations. Before removal by train was abandoned, it was necessary to haul material through a vertical height of 65 feet to the top of the cut. This was accomplished with grades generally from 2½ to 5 per cent. At the bottom short loading tracks were laid on grades as high as 8 per cent.

Preliminary investigations gave an accurate indication of the location of the rock and of the character of the material. The contractor took advantage of these in placing his track system and the location of switchbacks, and the planning of these is responsible in considerable measure for the satisfactory progress made in the deep cut.

The first of the two No. 70 Bucyrus shovels started at the conduit working on a slightly rising grade so as to drain back to the sumps. The track serving this shovel ran on a 2½ per cent grade to a switchback at the easterly end and thence along the edge of the up-stream coffer-dam. A similar track was laid on the down-stream side of the cut leading to the west switchback near the conduit and thence to the down-stream coffer-dam. After completion of the latter to elevation 213, the west switchback was discontinued and this track extended westerly to carry material into final position west of the conduit below the core trench on that side.

After the up-stream coffer-dam was completed, a new switchback was placed so that the material could be placed in final position on the up-stream side of the west core trench. This work was carried on throughout the winter, danger from freezing being avoided by dumping in water. As the cut was deepened, the two big shovels worked along together on opposite sides of the cut, the intervals between loading cars being occupied in moving

or in cleaning off around the numerous boulders which at places occurred in great quantity and in sizes up to 62 cubic yards. In this work and in reaching out-of-the-way places the draglines assisted. The sizes of trains varied from ten 4-yard cars, each hauled by one locomotive on the 2½-per-cent grades, to five 4-yard cars hauled by two locomotives on the short loading tracks having as high as 8 per cent grades. Some difficulty was experienced on the latter grades on account of the water tending to run out of the boilers. The record progress made in excavation was 42,000 yards a month for the two large shovels, which was considered entirely satisfactory in this bouldery sand and gravel, which is freely water-bearing. The shovels worked generally on a slightly rising grade with the line of saturation practically at the surface a large part of the time. The material was irregularly distributed, strata of coarse gravel adjoining large masses of very fine sand. Although the gravel predominated, the flow of water into the cut, though temporarily retarded locally by the fine sand, would greatly increase in volume once the sand was penetrated.

The No. 70 Bucyrus shovels carried the cut down to about elevation 135, or 65 feet below the surface, where on account of the constricted space and the saturated condition of the soil the remainder of the cut, about 5,000 yards, was removed by the No. 30 Bucyrus draglines and by hand digging and loading into 4-yard skips removed by cableway.

The cableway in use is a Lidgerwood button line cableway, steam-operated, of 804-foot span operating for about 500 feet lengthwise of the dam directly over the deep cut. The towers move on standard-gage tracks, the tail tower on the up-stream coffer-dam being 53 feet high, and the other 85 feet high on a fill below the dam. The cableway was put into service when the cut was about 40 feet deep, and was used thereafter in moving machinery and equipment and bringing in coal. Later on, it was used in delivering soil and previous refill to the more inaccessible portions of the work.

Obtaining the soil for the core of the dam and placing it, is next to the largest single item of work in the construction of the dam, the total requirement being about 500,000 cubic yards. As this soil has to be stripped by shallow excavation, hauled a considerable distance and then, after removal of roots over ½-inch in diameter, placed in 6-inch layers and thoroughly compacted with heavy rollers, it is also the most costly item of embankment.

The equipment used for these operations consists of steam shovels, bottom-dump wagons, dragline excavators, narrow-gage railroad and equipment, cableway, Adams graders with 8-foot blades, two Standard Winner graders, 6 wheel scrapers, 3 Monarch 15-ton special puddling steam rollers, 2 horse-drawn rollers, and a 5-ton Holt Caterpillar tractor. The following types of shovels have been used in these stripping operations: 2 No. 70 Bucyrus (2½ yards), 1 Erie B (¾-yard), 1 No. 29 Osgood (1-yard), 1 No. 14 Bucyrus (¾-yard), 1 No. 30-B Bucyrus (1-yard), all with caterpillar traction, except the 70-ton shovels, which have railroad traction and are used solely for loading.

**THE DEEPEST PORTION OF THE CORE TRENCH, SHOWING THE MATERIAL BEING LOADED INTO SKIPS BY DRAGLINES AND BY HAND**

**The top of the coffer-dam at elevation 230 is seen in the background**

Except for a relatively small amount obtained from stripping the site of the dam, the bulk of the soil is stripped from more or less scattered areas up-stream. To reach these, a main-line track has been extended up the valley as near as possible to the center of gravity of the areas to be stripped. Because of the extensive area necessary to strip, it was not feasible to lay tracks so that the soil could be handled directly into the cars, so it is excavated by the small shovels, hauled in dump-wagons to storage piles alongside the track, and when required, loaded by steam shovels into 10-car trains to be transported to the dam.

The storage pile is a necessary part of the procedure, because it would not be economical to excavate soil at a rate sufficient to meet the peak demand for soil. It is a slow process even on cleared land, and it has been found necessary, in order to obtain the requisite quan-

tity without going too great distances, to obtain soil from many wooded areas after clearing.

Placing the core is preceded by removing loose and disintegrated rock by hand methods so as not to open up seams, drilling grout holes generally not over 20 feet deep, and laying a concrete blanket about 30 feet wide centering on the core. This blanket varies in thickness with the contours of the rock foundation, and in places where the rock is sufficiently sound and irregular in contour the blanket is omitted.

Soil core in the deep cut was placed on the high portion at the westerly end first and extended down to meet that placed in the bottom of the hole. The latter was at first delivered by cableway, a considerable part of it being spread from moving skips without lowering, and later on, as the core was being built up from the bottom of the deep cut, the cableway delivered soil to places inaccessible to the track system.

When the core had been built up to a grade of about 5 per cent leading from the west switchback near the conduit, a track was laid on the core, and most of the soil was delivered thereafter by dumping from cars.

The most interesting feature of the placing operations is the performance of the 5-ton Holt tractor. This machine spreads the soil by drawing a heavy road-grading machine, and is used also to shift track. Its power and agility have made it invaluable, particularly on the large fairly flat areas. Large roots must be removed, and it has been found cheaper to remove and burn these at the dam when the soil is being placed rather than before hauling it to the site. A considerable labor force is required for the placing operations, anyway, so that some of these can sort out the roots in the intervals between their other duties, whereas most of the work at the borrow areas and storage pits is done by machinery.

The largest item of work is sand and gravel embankment which backs up the core. The refilling in the core trench has been done by dumping from trains by cableway and also to a limited extent by sluicing material down from the sides of the cut. This fill has to be compacted by water, so that it is desirable to have the ground-water level as high as possible for this purpose, at the same time keeping it sufficiently below the soil level to prevent it from becoming too soft to work on.

Because of the presence of numerous boulders, placing and rolling this fill would have been prohibitive in cost, and as there is no objection to the presence of boulders, provided the fill is dense and compact, the specifications called for placing by allowing the ground water to rise on it in the cut and by the use of streams of water above ground. These methods, as well as dumping in water, have all been used in placing the material for the embankment.

During the past winter some pervious fill has been placed above the level of the core by building dikes to hold back the water from the core.

The foregoing description relates to the construction of the main dam and more particularly to the deep cut, its excavation and refilling. Many minor operations have been in progress at the same time, including excavation of a spillway channel 1,800 feet long, involving 98,000 cubic yards of earth and 16,000 cubic yards of rock, and the construction of a reinforced concrete bridge to cross the spillway. A large part of the work, the building of the dam above the ground, is yet to be done. The deep core trench is the most difficult part of the work, however, and on the rapidity of its excavation and refilling depended the economical prosecution of the whole project. The excavation was planned to occupy 15 months and was so timed because the lowest part would then be reached during what is invariably the dry season. This work was completed on schedule and undoubtedly would have been ahead of time but for the unusually wet summer of 1922, the heavy rains causing considerable erosion of the slopes at the time when the cut was at its most difficult stage.

Items of contractor's plant not specifically mentioned in the foregoing are: 7 Vulcan, 2 Porter and 2 American 21-ton locomotives; 126 Western 4-yard dump-cars; 5.3 miles of 3-foot track; 3 guy derricks with 60-foot booms; 41 dump-carts and necessary drilling, grouting and concreting equipment. The plant comprises a sawmill, machine shop, carpenter shop and blacksmith shop.

The work described herein is being done for the Water Supply Board of the city of Providence under the supervision of Frank K. Winsor, Chief Engineer, by Winston & Company, Inc., of Kingston, N. Y. The General Manager in charge of the contractor's operations is M. J. Look.

## Massachusetts Spent $9,000,000 for Highway Work in 1922

### Bituminous Construction Predominates in Bay State Road Work

DURING the year 1922 the state of Massachusetts spent a total of $9,000,000 for the improvement of its highways. A total of about 212 miles was constructed or reconstructed, the mileage being approximately the same as in 1921. Of this mileage, 32 miles was of cement construction, 78 of bituminous macadam with asphalt, 21 of bituminous macadam with tar, 16 of bituminous concrete, 2¼ of water-bound macadam, and 62 miles of gravel.

Massachusetts reports the remarkably low maintenance cost of ½-cent per square yard, equal to $52.80 per mile of 16-foot road for its large mileage of asphalt macadam pavement.

# Legal Points for Contractors

**These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer**

**Edited by A. L. H. Street, Attorney-at-Law**

### What Is "Reasonable Time" for Completing Work?

Conditions encountered by a contractor in performing a contract, as well as conditions contemplated by the parties when the contract was made, are to be considered in determining what is a reasonable time for completion, holds the United States Circuit Court of Appeals, Sixth Circuit, in the recent case of Pitt Construction Co. vs. City of East Liverpool, Ohio, 285 Federal Reporter, 236. The Court said, in the course of its opinion:

"In the normal case, one test of reasonable time is the time within the contemplation of the parties in making the contract.

" 'If they then talked it over and understood it alike, while that fact would not fix the exact limit, it would show about what they understood it would be.' Eppens vs. Littlejohn, 164 N. Y. 187, 195, 58 N. E. 19, 22 (52 L. R. A. 811).

"The time contemplated by the parties when the contract was made is not, however, necessarily the sole and final test. It is usually but one element in such determination.

"The question whether the time taken for performance was reasonable or not must take into account all the circumstances and conditions encountered at the time the contract was being performed, provided, at least, that the one charged with such performance, in preparing therefor, and in meeting the conditions when they did occur, exercised the reasonable care which an ordinarily prudent person would have exercised under like conditions."

### When Contract Is Silent As to Time for Paying Contractor

The importance, from a contractor's standpoint, of having specific understanding as to when payments are to be made to him on account of particular work is indicated by the decision of the New York Court of Appeals in the case of Stewart vs. Newbury, 115 Northeastern Reporter, 984. In that case, question was raised as to whether or not a contractor was entitled to payments while work was in progress. A lower court had instructed the jury that, although there was no agreement as to payments, still the contractor would be entitled to part payments at reasonable times, as the work progressed, and that if such payments were refused he could abandon the work and recover for work done. Holding that this was an erroneous statement, the Court of Appeals said:

"The law is very well settled to the contrary. This was an entire contract. . . . Where a contract is made to perform work and no agreement is made as to payment, the work must be substantially performed before payment can be demanded."

The Court cited a decision reached by it in a case where it was decided that where a contract "to do all the brick work for 22 houses . . . for the sum of $4,600" was silent as to time for payment, no payment was due until all the work was completed.

### Agreement to Pay Contractor Extra Compensation Held Void for Want of Consideration

A section of the New York constitution forbids grant of extra compensation to public contractors. Applying this provision, the New York Court of Appeals decided in the recent case of McGovern vs. City of New York, 138 Northwestern Reporter, 26, that an agreement by the city to pay subway construction contractors the increase in the cost of labor and materials entailed by war conditions was void. The Court observed that it had previously "held that there is no power to repair out of the public purse the losses that war prices have brought to contractors with state or municipality in the performance of their contracts." Proceeding, the opinion adds:

"The contractors say that what they are seeking is not a gift in form or substance, not an extra at all, in the sense of gratuitous concession, but the stipulated equivalent for the surrender of a right. The right, when subjected to analysis, will be found to be illusory, Millions were promised by the city in return for an unreal surrender. Either there was no consideration at all, or the shred of value, if any, is so grossly disproportionate to the return that to uphold it as sufficient would be to nullify the constitution by subterfuge and fiction.

"We are told that a right was surrendered when the contractors paid the wages that were necessary to keep the work in motion and avert its disruption and suspension as a result of a protracted strike. In the circumstances disclosed by the complaint, they could not have done less without being guilty of a wrong. They had covenanted to build the road and to keep at all times upon the work a suitable supply of men. This meant that they must hire the labor and pay the wages necessary to permit them to proceed. Their duty was to avert the strike unless there was a reasonable prospect that, without unreasonable delay, other labor could be obtained at cheaper rates."

**Ratification of Contracts Made with Corporate Officers**

Because the scope of power of a corporate official to bind his company by contract is limited, caution should be exercised by a contractor in making a construction agreement with such an official. But it does not necessarily follow that a contract is unenforceable merely because a corporation's representative has exceeded his authority in making it. There are numerous decisions showing that omission of the company to disaffirm may amount to ratification of the contract. And ratification is equal, in legal effect, to prior authorization.

In a case decided by the United States Circuit Court of Appeals—Leroy & C. Valley Air-Line Railroad Co. vs. Sidell, 66 Federal Reporter, 27—it was said:

"When the president of a corporation does, in its behalf and within the scope of its charter, an official act which requires the concurrence of the board of directors, and the board, knowing that he has done so, does not dissent within a reasonable time, it will be presumed to have ratified his act, and when an official act is performed by the general agent of a corporation, in its behalf and for a purpose authorized by its charter, and within the scope of his ordinary powers, and the corporation knowingly receives the benefit of the act without objection, it may be presumed to have authorized the contract of its agent."

**Municipal Regulation of Concrete Contractor's Business**

Limitations on the power of a city to impose license taxes and other burdens on the business of laying concrete are indicated in the very interesting and important opinion handed down by the Wyoming Supreme Court in the case of State vs. City of Sheridan, 170 Pacific Reporter, 955. In that case it was decided that an ordinance of defendant city was void in its requirement of a license fee of $15 and for filing of a $1,000 maintenance bond of persons engaged in the business of constructing sidewalks of concrete, cement, or other artificial stone. In the course of its opinion, the Court said:

"There is a sharp distinction between a license for revenue and one of regulation under the police power; the first named being a tax and constructed under the principles and rules governing taxing powers, the latter under the police power, looking toward the health, morals, safety, or general welfare of the community, and it is generally held that power to regulate occupations does not in itself give the power to license for revenue or tax the same occupations, or that a given power to license for revenue does not in itself give power to license for regulation under the police power. . . .

"The right to follow any of the common occupations of life, or to earn one's living in any innocent vocation without let or hindrance, is one of the inalienable rights covered by the statements in the Declaration of Independence, and sacred to all those living under our form of government by the liberty, property and happiness clauses of the national and state constitutions.

"Viewing the ordinance in question in the light of the above principles, we are constrained to hold that it is unconstitutional and void, because: first, that the vocation of cement contractor is not a proper subject of police regulation, not affecting either the health, morals, safety, or welfare of the public generally, so as to be a necessary subject of regulation; second, that no express power to regulate this vocation is conferred upon the city, and none can necessarily be implied from the powers granted; third, that were the power given, the regulations required are unreasonable, especially in requiring a maintenance bond to run five years; fourth, that the ordinance is discriminatory and class legislation in that it requires a fee and bond from one laying concrete or cement sidewalks, and requires neither from those laying sidewalks composed of asphalt, granite, vitrified brick, or any other hard and incombustible material."

As an independent ground for annulling the ordinance, the Court holds that it unreasonably interferes with the right of a property owner to contract for the construction of sidewalks, etc., required to be constructed by him under local ordinances. The interference consists in the requirement for filing by the licensed contractor of a maintenance bond, although the property owner may be willing to trust to the character of work done by the contractor selected by him without such bond.

**Bid May Be Withdrawn Before Being Accepted**

A bidder for a building contract was entitled to return of a check deposited with his bid to secure entry into a contract on acceptance of the bid where the bid was withdrawn before being acted upon, on the ground of mistake in making it. It was so decided by the Iowa Supreme Court in the case of Younglove vs. Hoberg, 191 Northwestern Reporter, 985. The Court rested its decision, not on the ground of the mistake made in preparing the bid, but on the general proposition that a bid may be revoked before it is acted upon. The opinion says:

"The appellee [the bidder] is not seeking to be released from a building contract because of a mistake in making his estimates as the basis of his bid. He is seeking to recover the amount of the check deposited by him, on the theory that no contract whatever was entered into between the parties, and, therefore, that there could be no forfeiture of the check. His contention is that the offer contained in his bid was not accepted until after the same had been withdrawn, and that, therefore, no contract was performed between the parties. . . .

"The law in cases of this kind is well established, and quite elementary. An offer may be withdrawn at any time before it is accepted, and the acceptance communicated, when communication is necessary."

# The Little Things That Eat Up Profits

## A True Story Showing the Value of Simple, Adequate Cost Accounting

THE contractor who recognizes the existence of the little things on his jobs, who takes care that the number of them shall remain within reasonable bounds, and who exercises restraint to encourage them to develop along proper lines, need have no fear that they will overwhelm him in their later strength. When they reach the point of asserting themselves, he will be prepared for them, but the man who tries to close his eyes to their existence and refuses or fails to recognize them, will sooner or later find them a tremendous handicap.

H. deB. Forbes, of Broaddus, Forbes & Company, Richmond, Ky., contractors, has published in *The Scraper* some actual cost data on the construction of several small concrete structures. These figures are taken from the books of the company, not estimated, and they show the actual cost of this work which has been completed.

The work consisted of nine bridges built during the fall of 1921 and the spring of 1922 in Clark County, Kentucky. The bridges ranged from 6-foot spans to three 30-foot T-beam slabs in one bridge. The average weighted haul on materials was 4.1 miles. Roads were good, being surface-treated macadam with no bad grades. Teams were used almost entirely for hauling. In this particular case it is probable that truck haul would have been slightly cheaper, but the difference would have been small. The figures given below are actual costs taken from the company's books, with no profit of any sort included. The teams were figured at $5 per day, as that was the prevailing rate at the time, although as a matter of fact the team account showed a slight loss at this figure. Labor was paid 25 cents per hour, and carpenters 50 cents.

Thorough consideration of these figures will confirm Mr. Forbes' statement that it is the little things that count. It is customary for most contractors in discussing the cost of a particular operation, say, small concrete structures, to find it easy to reel off costs of excavation, cement, sand, gravel, stone and the labor of mixing and placing; then to add up these items and feel that they have covered the cost of the work reasonably closely. It is an easy and a common fault to forget the little things which are absolutely indispensable, but incidental to every piece of work. They may be remembered to the point of adding a very small percentage to cover such items, but the guess seldom runs higher than about 5 per cent. If these conditions are true, consider again Mr. Forbes' data and see how near the estimate arrives at actual conditions.

Picking out the cost of what may be termed the major or easily remembered items, the cost per yard is as follows:

| | Per Cu. Yd. |
|---|---|
| Excavation | $1.513 |
| Cement | 8.827 |
| Sand | 1.495 |
| Stone and gravel | 3.057 |
| Forms | 4.002 |
| Mixing and placing | 1.463 |
| Hauling | 2.416 |
| Total | $17.773 |

If 5 per cent for incidentals and overhead is added, the estimate must be increased 89 cents, making a total of $18.60 per yard. If 10 per cent for profit is added, a contract would be signed on the basis of $20.50 per cubic yard.

Assuming that the contractor executes every item included in the estimate of $17.77 exactly at the estimated cost and is receiving $20.50 for every yard of concrete placed, under these conditions he will fully believe that the cost of $17.77 leaves him an apparent margin of $2.73 profit. Going back over Mr. Forbes' data again, we find that the following little things have been entirely overlooked, although they are furnished with their daily food from the contractor's bank account:

| | Per Cu. Yd. |
|---|---|
| Detours | $.626 |
| Refill | .435 |
| Carborundum finish | .443 |
| Drains | .034 |
| Expansion joints | .042 |
| Hauling men to work | .180 |
| Small tools | .193 |
| Moving to job and return | .232 |
| Use of machinery | .262 |
| Liability insurance | .393 |
| Contract bond | .313 |
| Superintendent, transportation, board of foreman, miscellaneous overhead | 1.341 |
| Total | $4.494 |

Thus, without realizing it, the little fellow that was thought to be unworthy of anything but an offhand 5 per cent consideration, has grown up in a remarkably short space of time to be a real husky member of the family, demanding and receiving not only the anticipated profit of $2.73, but going on further into the bank account, leaving a deficit or loss of $1.76 per yard. This little fellow, rated at 5 per cent, has suddenly developed to a point where he is actually 25 per cent of the big things which were thought worthy of consideration.

Contractors looking over last year's business may find several instances where this fable has turned out to be a sad, true story. Bid after bid has been made and many contracts signed in which the concrete is figured at the old "standard" price of $18. This figure is very close to the $17.77 estimate shown above, and many a contractor, after sad realization that his loss is actual, has wondered how it came about. Unless a careful, thorough, intelligent cost account has been kept, like that shown

CLARK COUNTY BRIDGE COSTS 1921-1922

| Item | Item Amount | Sub-Total | | Item Total | Concrete Per Yard |
|---|---|---|---|---|---|
| Excavation—labor | $1,540.86 | | | | |
| Explosives | 47.34 | $1,588.20 | | $1,588.20 | $1.513 |
| Detours—labor | 354.12 | | | | |
| Lumber nails, bolts | 147.41 | | | | |
| Crushed stone | 107.50 | | | | |
| Fencing, lanterns, miscellaneous | 48.77 | 657.80 | | 657.80 | 0.626 |
| Refill—labor | 456.43 | 456.43 | | 456.43 | 0.435 |
| Cement, 1,402 barrels, 3.02 | 4,232.04 | | | | |
| Cleaning and tieing sacks | 12.50 | | | | |
| Freight, returned sacks | 37.57 | | | | |
| Unloading and storage | 236.60 | 4,518.71 | | | |
| Less sack credits | | 500.30 | | 4,018.41 | 3.827 |
| Sand, 692 tons 2.242 | 1,551.46 | | | | |
| Unloading (1) | 17.80 | 1,569.26 | | 1,569.26 | 1.495 |
| Crushed stone 926 tons $2.50 | 2,315.00 | | | | |
| Gravel 338 tons $2.65 | 895.70 | 3,210.70 | | 3,210.70 | 3.057 |
| Forms—lumber and nails | 2,002.24 | | | | |
| Form ties, bolts, etc | 117.17 | | | | |
| Form oil | 13.25 | 2,132.66 | | | |
| Less lumber sold | | 463.72 | $1,668.94 | | |
| Form labor | | | 2,533.33 | 4,202.27 | 4.002 |

| | Item Amount | Sub-Total | Item Total | Concrete Per Yard |
|---|---|---|---|---|
| Mixing and placing labor | $1,474.58 | | | |
| Gasoline, oil, grease | 27.80 | | | |
| Batteries | 9.35 | | | |
| Mixer repairs | 24.10 | $1,535.83 | $1,535.83 | $1.463 |
| Carborundum finish—labor | 417.53 | | | |
| Bricks | 47.50 | 465.03 | 465.03 | 0.443 |
| Drains | 35.50 | 35.50 | 35.50 | 0.034 |
| Expansion joints | 43.91 | 43.91 | 43.91 | 0.042 |
| Hauling—team time | 2,043.76 | | | |
| Truck hire | 492.46 | 2,536.22 | 2,536.22 | 2.416 |
| Hauling men to work—gasoline, oil, tires, etc | 188.06 | 188.06 | 188.06 | 0.180 |
| Small tools | 202.38 | 202.38 | 202.38 | 0.193 |
| Moving to job and return | 243.70 | 243.70 | 243.70 | 0.232 |
| Use of machinery: | | | | |
| Concrete mixer | 75.00 | | | |
| 1-ton truck | 150.00 | | | |
| Small derrick, miscellaneous | 50.00 | 275.00 | 275.00 | 0.262 |
| Liability insurance | 412.77 | 412.77 | 412.77 | 0.393 |
| Contract bond | 329.05 | 329.05 | 329.05 | 0.313 |
| Superintendent | 700.00 | | | |
| Superintendent transportation | 241.40 | | | |
| Board of foreman | 292.70 | | | |
| Miscellaneous overhead | 174.22 | 1,408.32 | 1,408.32 | 1.341 |
| Total expense, 1,050 yards concrete | | | 23,378.84 | 22.267 |

REINFORCING

| | |
|---|---|
| 65,570 lbs. @ $2.44 per 100 bent and delivered f.o.b. Winchester | $1,599.91 |
| Unloading and hauling | 89.70 |
| Spacers, ties, saddles, etc | 122.20 |
| Labor, placing | 477.53 |
| Insurance | 32.65 |
| Bond | 53.11 |
| Superintendent and transportation | 81.15 |
| Miscellaneous overhead | 30.17 |
| Total expense, 65,570 lbs. | $2,486.42 |
| Per 100 lbs. | $3.79 |

from the books of Broaddus, Forbes & Company, they will never realize how much money it has cost to take care of the little things that were forgotten in their estimates.

# Building the New Yankee Baseball Stadium

**The Construction of the Greatest of Amphitheaters Developed Remarkable Efficiency in Mixing and Distributing 20,000 Yards of Concrete in Small Quantities Over a Large Area Without Hand Work**

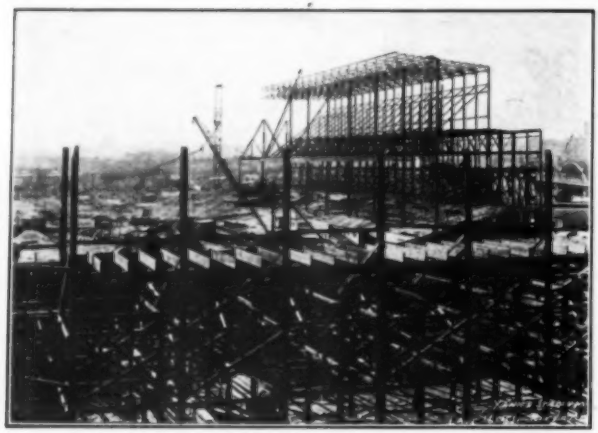
THE remarkable baseball park of the American League Baseball Club of New York is now practically completed at 161st Street and River Avenue, Borough of the Bronx, New York City. The grounds provide a baseball field with a fairway of 138,000 square feet, or more than 3 acres, with an extreme length of 500 feet from the home plate to the limits of the field, which is practically enclosed by grand stand and bleachers with an ultimate capacity of 80,000 seats. Work was commenced May 8, 1922, and, notwithstanding a large amount of costly grading and foundation work, the stadium was more than 90 per cent completed before concreting was stopped by cold weather, and is now practically complete for this baseball season.

The grand stand resembles in plan an irregular horseshoe, 1,787 feet long around the outer edge. It has three sloping tiers of seats with concrete floors. The lower tier, under which are club rooms, dressing-rooms, reception rooms, ticket office, storage, etc., are supported directly on concrete columns, girders and walls, while the upper tiers are supported on steel trusses and sheltered by steel truss roofs with extremely long cantilevers to avoid columns obstructing the spectator's view. The top of the roof is 103 feet above the ground, the highest seats are 93 feet above the ground, the rear wall is 76 feet in height, the steel columns and trusses weigh 2,000 tons, and there are 20,000 yards of concrete in the structure and its foundation. The wooden bleachers, commencing at both ends of the grand stand, complete the enclosure of the field and will have a large additional seating capacity. There are three entrances to the bleachers and one main entrance to the grand stand. The entire baseball field is enclosed by a cinder track that separates it from the bleachers and grand stand. The area of the ball ground exceeds that of the famous Polo Grounds in Manhattan Borough by 20,000 square feet.

CONCRETING THE SUPERSTRUCTURE OF THE GRAND STAND

The site of the stadium is a deep fill where great quantities of rock and broken stone from the subway excavations were dumped, and in order to grade it properly it was necessary, first, to excavate 20,000 yards of earth and stone, which was done in four weeks with two steam shovels, besides which 60,000 yards of earth fill were dug by two steam shovels and hauled an average distance of 500 feet to level up the low places and for surfacing.

The first work to be completed was the surfacing and drainage of the baseball field, which is a turtleback, crowned 2 feet higher



ERECTING THE STEEL WORK OF THE GRAND STAND

at the pitcher's box than at the base lines, and thoroughly drained by 2,200 lineal feet of 4-inch subsurface terra cotta tiles radiating in 24 lines from the pitcher's box. The White Construction Company, Inc., general contractors, has prosecuted the work vigorously with a maximum force of about 400 men.

### Difficult Foundations

Holes about 2½ feet deep were excavated in the loose rock fill for the column foundations, and in them wooden forms were set for the sides of the piers. The bottom of the pit was then thoroughly washed out by a high-pressure hydraulic jet that thoroughly cleaned the interstices between the stones, which were filled with a dry mixture of one part cement and four parts sand washed down into the cracks by a hydraulic jet operated until all the voids were filled and the mortar-like substance carried out into a pyramidal slope on all sides to form a smooth, level surface in the bottom of the pit, on which the piers were built.

Notwithstanding these precautions, it was thought wise to provide for any possible settlement of the heavy steel-and-concrete superstructure, and to this end the upper surfaces of the piers were covered with double steel plates, on which the pedestals and upper portions of the walls were concreted. Rectangular openings through the walls and pedestals were provided in the concrete so that in case of any future settlement, horizontal steel needle-beams can be inserted in them and jacked up, raising the superstructure to compensate for the settlement and maintaining it there until steel shims are inserted between the double plates to provide permanent bearing.

On account of the great number of piers and the irregular curve of the structure, great pains were required in laying out the different points, and two engineering parties were occupied four months in giving the necessary lines and levels. The concreting of the foundation was commenced June 19, and of the main deck August 4.

### Concrete Plant

About 200 yards of broken stone and 100 yards of sand were delivered daily from 145th Street by a fleet of 5- and 6-yard motor trucks, and were dumped in storage piles on the surface of the ground, the stone being dumped against wooden bulkhead walls 10 feet high and 60 feet long, one of which was built near each of the three mixing plants. In each pile the stone was dumped over the boot of a home-made elevator that filled a 16-yard receiving bin 22 feet above the ground. The bin delivered by gravity through a gate to the batch hopper with which the mixer was charged. Adjacent to each mixer there was also a 6,000-bag cement shed and a sand storage pile, from which the cement and sand were wheeled to the mixer, which was set in a sheeted pit below ground level so that each charging hopper could be filled by wheelbarrows.

### Efficient Concrete Handling

A very complete equipment of standard Ransome concrete plant was installed, and by its arrangement and notably satisfactory operation insured a high quality and continuity of work and functioned efficiently in serving all parts of the grand stand (with a length of more than 1,400 feet, an area of nearly 200,000 square feet and a height of 76 feet) by mechanically conveying and placing concrete and eliminating hand work. Besides this grandstand plant, which included three 135-foot steel towers and spouting equipment and three ¾-yard electrically-driven mixers with batch measuring hoppers, there were an additional ¾-yard electrically-driven stationary mixer with batch-measuring hopper and two ¼-yard portable gasoline-driven mixers mounted on trucks, that were used chiefly for pouring the small bleacher piers.

The concrete towers were located just beyond the high rear wall of the grand stand, one of them at the center point and one about half-way from each end. Each tower was completely equipped with a quick-shift counterweight system, consisting of an open steel boom, a boom section chute, a counterweight chute, and a 48-foot truss chute, the whole having a combined radius of 137½ feet independent of supporting cables, bents or poles, and was supplemented by a 48-foot extension chute, which could be supported at the upper end and swung to command a complete circle

The concrete for the main decks was waterproofed with Trus-con dissolved and added to the mixing water. When not delayed, each

of the mixers averaged 200 yards of concrete in one 8-hour shift, which was mixed, distributed and placed in the forms by a total force of about 16 to 18 men, including 5 to 8 spaders, who thoroughly worked the concrete in the forms with standard 4 x 1-inch slice bars. Each batch of concrete was mixed for at least 60 seconds, accurately timed by the inspector, and the proportion of mixing water was frequently varied in accordance with atmospheric conditions. The 27-cubic-foot concrete bucket was hoisted at a speed of 150 feet per minute, and the concrete was spouted without difficulty to a maximum distance of 150 feet.

The ease and rapidity of the work were notably promoted by the use of portable chutes, 16 inches wide, that were made in several 14-foot lengths to supplement the steel chutes. Each section was provided with two or three butterfly side gates, opening inwards, that permitted the concrete to be discharged simultaneously through one, two, or three lateral openings, thus making several branch chutes serve different small forms. The use of the special chutes and gates was considered to effect a considerable economy of time and labor.

The chutes and mixers were thoroughly washed every night, and no difficulty was encountered in maintaining the flow of concrete in spouting. On account of the intricacy of the job, it was considered that the counterbalance trusses and spouting system were especially desirable and provided a more satisfactory installation than would have been furnished by some other type of distribution.

The original plant was selected and installed for the construction of the three sections of the grand stand that it was at first proposed to erect initially; later, when it was decided to add a fourth section to the original construction of the grand stand, another 75-foot-high steel hoisting tower was added and the fourth stationary mixer was used to operate it.

About 128,000 feet b. m. of timber were required for the forms, which were made, shifted, stripped, cleaned and repaired by a total carpenter force of 160 men, including 35 men building the wooden bleachers. These men were divided into different squads, with superintendents for the various classes of forms, such as columns, walls, floors, steps, seats, etc., and the forms, as fast as finished, were numbered, clamped and stored until used. The concreting was commenced with four gangs working on column footings, two gangs on low walls and floor, one gang on upper part of walls and floor, and another gang on the boxes. The forms were used up to a maximum of about five times each, and were stripped clean, repaired and brushed with petrolatum by two gangs.

The Trenton wire cloth used to reinforce the steps in the upper decks was received in long sheets and bent to right angles in reverse directions every few inches to fit the threads and rises. These bends were rapidly and accurately made by a special two-jointed hand brake.

There were 350 tons of ⅜- to 1¼-inch square twisted reinforcement bars up to 68 feet long, which were received in straight lengths and stored according to length and size. They were bent by hand by two 2-men gangs, using a home-made skeleton table with angle-iron framework, having the longitudinal top bars punched with frequent holes to permit the adjustment of movable transverse pieces, also having flanges punched to receive clamps in any position that secured the bars and enabled them to be rapidly bent by long levers.

The high rear wall was concreted in forms made with 3,000-pound wooden panels handled by a 3-part hand windlass, tackle-suspended from a 10 x 10-foot horizontal counterweighted triangular frame that was slid along on top of

**THE GRAND STAND NEARLY COMPLETED, SHOWING THE PLAYING FIELD AND HOME PLATE JUST UNDER THE SIGN "YANKEE STADIUM"**

the roof and projected about 3 feet to clear the wall.

The work done was recorded on daily report sheets, having on the back a diagram plan of grand stand and bleachers, with the different panels of the latter numbered in one direction from "1" to "75" and in the opposite direction lettered from "A" to "K," inclusive, thus locating every column. The areas were colored to indicate the classes of work completed daily—yellow for forms, red for concrete, blue for steel, and black for other details, and finished columns and slabs were circled.

The report had blanks for temperature at 8:00 A.M., 12:30, and 4:30 P. M.; for weather conditions; for the number of bags of concrete used in floor finish, brick work, partitions, and patching, together with the respective number of men and number of hours worked. Another column gave the time sheet for carpenter foremen, labor foremen, hoisting engineers, carpenters, carpenters' laborers, cement masons, metal lathers, laborers, watchmen, and bricklayers. Lines were ruled for the different subcontractors and the men they employed, and spaces were provided for notes on the subcontractors behind in the work; for the materials immediately required; and for a summary of the day's work, stating the reasons for any delays, and the date at which any items of work were started and completed by the subcontractors, the whole being signed by the timekeeper and superintendent.

The steel contractor, Taylor & Fiether Company, erected the steel columns and trusses with a 2-boom mule traveler, operated on the second floor of the grand stand, and a movable steel stiff-leg derrick. Twenty-one days of steelwork were erected in 45 days with a gang of 30 men, and the riveting was done with three gangs, using pneumatic hammers operated by one portable air compressor. The traveler was operated by steam power, but all other equipment on the job was driven by electric motors, of which twelve, from 10 to 65 h.p., were installed.

The freedom from all serious accidents and the rapid, steady progress of the work were attributed largely to the capable management and excellent organization and to the careful selection, arrangement and installation of the abundant, high-class mechanical equipment, all of which was of improved model with extra heavy and well-finished details, as, for example, in the mixing machines, where the drums were mounted on large rollers with Hyatt roller-bearings and were provided with heavy steel locomotive tire treads manufactured by the Baldwin Locomotive Company.

The sliding frames on the hoisting towers provided for the accurate adjustment of the boom heel, receiving bin and boom lead bracket, and could be quickly shifted and secured so as to permit the minimum travel and maximum speed of the bucket to secure the quickest and most continuous service, a matter of importance for the cost reduction of a job of this nature.

The hoisting towers were of very rigid construction to enable them to withstand the stresses from the long boom and counterweight. They weighed about 17,000 pounds each and were made with Z-bar and angle-iron members, shop-riveted in 15-foot lengths, rapidly assembled and bolted together at the steel connections. They were guyed every 45 feet from bottom to top with four ¾-inch turnbuckle ropes that were generally anchored to huge fragments of rock, serving as dead men, and subsequently permanently enclosed in concrete, from which the guy lines were cut away for removal. The towers were erected complete in about four days each, and the boom and hopper could be shifted, from time to time, in one hour.

The straight-back bins, mounted on the towers, had capacities twice as great as those of the hoisting buckets that served them. They were equipped with radial gates with long levers controlled from the operating platform on top of the bin. This bin supplied a boom chute that discharged to a small hopper at the top of the chute on the 48-foot-long counterweighted truss suspended from the boom.

The open steel boom, 48 feet long, was built entirely of angle-iron, with a center clearance, permitting the chute to pass through it. These features and other standard details of the equipment provided strength and rigidity, together with facility of operation, that were found very satisfactory elements of the cost and quality of the work executed.

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## Gambling With Fate

*Courtesy of The National Sand and Gravel Bulletin*

**The contractor using unsuitable sand and gravel in concrete construction is gambling with Fate. The stakes are the safety of human life, of investment, of reputation, against a trifling additional profit**

# The Unwarranted Demands of Labor

F. B. ROGERS, of Fred T. Ley & Company, Inc., New York City, at the recent conference of builders, held in New York, for a discussion of the present building situation, outlined his company's recent experience with the unwarranted demands of labor on one large operation as follows:

"The bricklayers made claim for certain cutting work in cinder concrete floor arches, usually done by the piping trades for their installations. Negotiations for settlement between the trades having failed, the bricklayers threatened to withdraw, and later struck the job, demanding that their wishes be complied with.

"The piping trades were equally as insistent that they do the cutting. Pending arbitration, and after one short strike of two hours, the bricklayers again struck at this time, adding to their demands an increase to $12 per day.

"As soon as they had done this, the bricklayers' tenders withdrew from the job, advising that they would not return for less than $8 per day, providing the bricklayers got $12. All efforts to again man the work were unsuccessful, and for over a week the masonry work was at a standstill.

"When the demands of the laborers were met, the work again started and continued for about seven working days, when a new demand was made by the bricklayers for $14 per day. There seeming to be no alternative, and in order to guarantee the completion of the masonry work so that other trades could continue and the building be completed for fall occupancy, the new demand of the bricklayers was acceded to.

Indeterminate loss was incurred, not only in money but in the progress of the building construction by the stoppage of the masonry work, which was added to because of the heavy loss in production per man during the interval while unrest existed on the job."

# Stabilizing the Building Industry

AT the conference of contractors, architects, real estate men, bankers and insurance men held at the Engineering Society Building, New York City, on April 30, Professor Lewis H. Haney, Director, Bureau of Business Research, New York University, spoke very forcefully of the great need in the building business to-day. He spoke in part as follows:

"The present up-swing in business is based on the building boom. It is from the demand for residences, business and industrial plants, and railways and public utility construction, that the general up-swing in prices is chiefly derived. This covers steel, lumber, linseed oil, brick, copper, and zinc, and many others. It follows that if this boom is not to be carried to excess, with a crash to follow, the building industry must be stabilized. Unless the pyramiding of prices and expenses is checked, the whole structure will collapse soon, and violently. Such a collapse will affect all other industries.

"But to stabilize the building industry requires that the price of buildings and the expense must be brought into line. If expenses are to pyramid just as prices are near the top, a collapse will be precipitated. In my judgment, the price of buildings is near the peak. Already at certain points, such as Philadelphia, Boston and Chicago, the volume of contracts shows signs of turning down. The feverish bidding for labor, apparently without regard to cost of construction, is a sign of the speculative peak.

"A 'buyer's strike' with regard to residences is already at hand. I am informed that a large construction company which has built many medium-price residences in northern New Jersey, has quit operation. The people are beginning to wait just as they did in 1920.

"A study of the price curves for building materials indicates that they are reaching a similar position to that occupied in April, 1920, when the peak of the preceding boom was reached.

"Meanwhile, wages appear to be advancing. Unless the curve of wages in the building trades is synchronized with the curve of building prices, there will undoubtedly be trouble. Failure of wages to be checked promptly at the peak of the building activity would make stability impossible and would hasten a slump.

"I note that statistics show that residential rents (which are a fair index of income from residence property) are about 65 per cent above prewar times, while wages are up approximately 100 per cent. The wage level, therefore, appears to be out of line with the advance in rents. This condition is the more notable in that cost of living is only about 60 per cent above prewar times. There appears to be good evidence for the conclusion that wages are abnormally high, and unless the advance is checked, the up-swing in building will end in a crash, which will probably bring a reaction in industry in general."

**Watch your local public works officials who claim a great saving in the use of day labor on municipal work. Force an accounting. If it shows a legitimate saving over contract work, it is truly remarkable. A more thorough examination of the accounts usually shows up the fallacy.**

# Building the Scajaquada Creek Drain

## Buffalo, N. Y., Is Doing Away with a Public Nuisance Through the Construction of an Underground Drain

**By Patrick Kane, Jr.**
Buffalo, N. Y.

THREE years ago, at a general election, the people of Buffalo declared the Scajaquada Creek a public nuisance and voted in favor of having a large portion of it—that which flows through the east side residential district—converted into an underground drain. This, in substance, is now being taken care of.

The Scajaquada Creek proper flows through the entire north side of the city. Estimated approximately, the length is about six miles. The creek pursues a winding, diagonal course from east to northwest, emptying into the Niagara River. It serves as a non-sewerage drain to the adjacent territory, taking care of the outlying east side especially, where, because of land development, modern drainage has not yet been installed.

In accordance with the wishes of the people, action was begun on this underground drain at once. A survey was made, plans were drawn up and bids let, and the work started the following spring. Experts reckoned it a hard job, made difficult through the various obstacles to be overcome. Chief among these were the water and the rock problems. Hard, compact limestone was encountered just below the surface of the creek-bed. The drain itself, or rather that portion of it now under construction, is 6,000 feet long. And the average depth of rock to be excavated is 8 feet.

The water problem presented was to take care of the normal water flow while construction was going on. For the most part, pumps were used which drained this water into city sewers; for the rest, it was found necessary to cut through the strata of rock in such a way there would be a continual channel through the broken stone refill. Of course, in wet weather this rock work had to be suspended until the water subsided.

BUILDING THE SCAJAQUADA CREEK DRAIN IN FLORIDA STREET, BUFFALO

The drainage area of this creek is 22.40 square miles. During the summer months, the volume of water handled is very slight, but during the wet season the depth increases to as much as 8 feet. Estimating the width of the creek-bed at 45 feet, one appreciates that the volume of water carried by this creek is considerable. In drawing up the plans for this work, Metcalf & Eddy, consulting engineers, of Boston, Mass., after carefully studying the project, submitted a report on three different types of drains as practicable for a work of this kind. The first type called for a dish-bottomed drain with sidewalls, but no roof. This type was not recommended, and the city rejected it, as scum and refuse would collect on the surface of the open water in warm weather; also, the drain would form a breeding ground for mosquitoes. It would also have been necessary to bridge all street crossings for traffic purposes, thus entailing further expense.

The second type consid-

ered was a flat-bottomed drain with side-walls and arched roof. The dimensions of this drain were considerably smaller than those of the first type, and it necessitated a detention basin covering, say, 500 acres of land at the upper end to take care of the abnormal flow of water, which this drain was incapable of handling during the wet season. The expense of buying land to construct this basin would bring the total cost of this type of drain up to that of the third type. The city therefore rejected the second project as unsuitable.

The third project called for a flat-bottomed drain with side-walls and roof-arch similar to that of the second type, only larger. This type of drain was to be 14 feet high from the floor of the center of the roof-arch. The average width was 28 feet, and in some places it ran as wide as 33 feet. This drain is capable of handling a water flow of 5,600 cubic feet per second past a given point. This capacity was chosen after a careful study of rainfalls and flood flows, with the intention of making it adequate for such a flood as would probably occur about once in 25 years, after the district has reached such a point of development as it may attain in about 25 years. With the development in its present status, the critical flood would probably be met only once in 50 or 100 years. This is the drain selected by the city of Buffalo for Scajaquada Creek.

A CONSTRUCTION SCENE IN THE SCAJAQUADA CREEK DRAIN DURING WET WEATHER

### Bridges Eliminated

This drain does away with all bridges. In the present section under construction, six bridges have been removed, one of these a splendid, three-arch, massive stone structure which carried Humboldt Parkway. All streets crossing the new drain will be laid down over the arch, which will be constructed to sustain a load of 1,000 pounds per square foot, including its own weight.

The Buffalo Dredging Company, contractors, are in charge of the construction of the new drain. They are using the best materials obtainable, every lot or shipment received being thoroughly tested several times before being used. For the concrete work, Pennsylvania portland cement is being used, the testing of which is in charge of the R. W. Hunt Company. All steel used is tested by the Pittsburgh Testing Laboratories.

The side-walls and roof of this drain are of concrete, reinforced with two rows or layers of ¾-inch bars. These bars run horizontally as well as vertically, and where they cross each other are securely wired together so as to be held in place till the concrete is poured. On the top of the arch, about 9 inches separates the layers of iron reinforcement. In the side-walls, about 14 inches separates the rows of iron work. The arch throughout was designed for unusually heavy loads because of the probability of street crossings in locations which could not be foreseen, and also because of the possibility of the storage of heavy material over the drain in certain localities. The thickness of the concrete in the roof-arch is 12 inches at the center, sloping out to 21 inches near the side-walls. The side-walls are 18 inches thick, and are backed up by a solid, natural wall of limestone. The floor is of smoothly finished concrete, laid directly on the rock, the smoothness of the floor facilitating the flow of water by offering no obstacle on which sediment or silt can gather.

To fit the topography, the slope of the lower section of the conduit was made .0017 on tangents, and compensation for curvature amounting to .001 additional was provided on curves. In this section of the conduit, the velocity at times of flood discharge is expected to be about 15 feet per second, and under high velocities the loss of head due to curvature is known to be considerable. The upper section, construction of which has not yet been begun, will be built on a slope of .0008 on tangents and .0011 on curves. In this section,

THE END OF THE FINISHED ARCH OF THE SCAJAQUADA CREEK DRAIN

the maximum velocity will not exceed 11 feet per second.

The increase in velocity at the change of grade will involve a loss due to the additional velocity head required. This has been provided by a drop in the conduit, to be accomplished in a distance of 50 feet horizontally.

The capacity of the conduit, as designed, varies from 3,130 cubic feet per second at the upper end, to 5,620 cubic feet per second at the lower end, the total length being 15,380 feet. The drainage areas tributary to the creek are 16.15 square miles at the upper end of the conduit, 22.40 at the lower end, and 23.95 at the mouth of the creek.

In the slope or grade given this drain, the amount of rock excavation was kept as low as possible; at the same time, sufficient cover was provided so that the arch might be protected and the small water pipes and drains could be laid below the surface. All large water-mains and sewers that cross this drain will be raised and laid on the top of the arch, and will then function by the siphon method.

Manholes are provided at street crossings, giving access to either end for entrance. Weepers of 5-inch vitrified pipe are provided every 50 feet at the level of the bottom of the side-walls, to take care of water seepage through walls.

The forms used in the construction of the concrete arch are of the movable type—on wheels and tracks. They are of steel and can be moved as the work progresses. In constructing the side-walls, steel forms were used, while for the overhead arch work the top surface of the forms was of wood. The wooden forms are well oiled, and the seams where the sections of the forms join together are covered with strips of thin sheet-iron to prevent the fresh concrete from leaking through. Once the concrete is set, these forms can be loosened, dropped down and run out from under the arch.

Considerable curvature necessarily enters into the location of this drain. With but six exceptions, the deflections have been made with curves of 210 feet radius; and most of them represent changes in direction considerably less than 90 per cent. The six exceptions are: 95 feet radius, 110 feet, 146 feet, 154 feet, 260 feet, and 260 feet.

One portion of the old creek, approximating 1,200 yards,, formerly ran a crooked course parallel to Florida Street. At one end, this creek ran directly alongside the street, and at another point it was over 100 feet from the street. The engineers, in laying out the course of the new drain, saw here a chance for improving the new course over the old one; so instead of following the course of the old creek-bed, they made a new course directly through Florida Street. The street was dug out and the new arch-drain built within it. The old watercourse was then filled in, thus making additional land available for the use of the abutting property owners, should the city so authorize.

The cost of this drainage work is rather high on account of the existing market prices of materials and labor. In view of this, the city decided to divide the Scajaquada Creek job into three—possibly four—sections, and to proceed with the construction of each section as the financial condition of the city allows. The money to defray the expense of this improvement is to be raised by taxation, general or local, to be decided by the city authorities at a later date. In the meantime, the work on the first section is nearing completion— 6,000 feet of underground drain, built at a cost of $1,449,000, a worth-while improvement which has created much favorable comment.

# How to Speed Up the Curing of Concrete Roads

## The Use of Calcium Chloride Minimizes the Number of Days That Traffic Must Use the Detour

UNTIL three years ago two methods of curing concrete were usually employed, one curing under water by the construction of ponds to hold the water upon the surface, and the other by covering the newly laid concrete with earth and keeping the earth saturated with water from 14 to 21 days. With either of these methods it was necessary to keep the road closed to traffic for a period of at least 30 days, in order that the concrete might obtain the proper strength before traffic was allowed upon it.

ing of the road. By adopting a method of construction whereby a concrete road can be opened from 15 to 20 days sooner, an immense saving is made to the public, and the inconvenience is eliminated.

A contractor in using either one of the methods previously mentioned must maintain expensive equipment in the nature of boilers, pumps and pipe lines, together with added labor necessary to keep water supplied to the freshly laid concrete. As a matter of fact, it takes more water to properly cure concrete than it

**PATCHING WITH CONCRETE MIXED WITH CALCIUM CHLORIDE**
**The concrete is brought from a central mixing plant and placed in the section to be patched**

Concrete pavements are not built where the traffic is light, and during their construction the excess amount of traffic is carried by detours that are usually unable to stand a great amount of wear. The cost of maintaining these detours is very great, not only to those in charge of the maintenance work, but to the traveling public. For instance, should a road carrying 10,000 vehicles per day be surfaced with concrete and the traffic detoured to a parallel road a mile distant, then every vehicle which follows this detour must travel two extra miles, making a total of 20,000 miles per day for every day the new road is closed. With a running cost per mile of at least 5 cents, a total of $1,000 per day is paid by the public on account of the closdoes to run the mixer. In other words, practically one-half of the pumping expense can be eliminated by discontinuing the old method of curing. A very important item when the earth and water method is used, is the labor necessary to cover the concrete completely with earth and to remove this earth again after the pavement is cured. Then there is a never-ending argument between the inspector and the contractor as to whether or not a sufficient amount of water is kept on the concrete to insure satisfactory curing.

The exhaustive experimental tests conducted by the Illinois State Highway Department show that calcium chloride is to be recommended for curing and accelerating the set of concrete

pavement. For this type of work, the Dow Chemical Company, Midland, Mich., is supplying large quantities of "Dowflake" calcium chloride each year. This chemical resembles common salt in appearance, except that it is in the form of flakes rather than small granules. One application of this material will absorb a sufficient amount of moisture from the air to keep the pavement wet continuously 24 hours per day when applied properly. This feature makes calcium chloride especially desirable for curing concrete. As soon as a newly laid pavement has taken on enough set to permit an application of calcium chloride without marring, one man can easily apply it and still have three-fourths of the day to do other work.

Where portable mixing plants are used, the finishers often have time to apply the calcium chloride while the mixer is moving ahead, thereby eliminating the labor cost entirely so far as curing is concerned. The Illinois State Highway Department requires that the calcium chloride remain on the surface two to three hours, during which time it does its work. Contractors are particularly favorable to the use of calcium chloride because it eliminates the fret and worry of inspection troubles, one feature which alone is worth the cost of the material. By adding calcium chloride to the surface of the concrete, a certain amount is absorbed and a higher strength is obtained at an earlier date than would be possible by the old method of curing. As a matter of fact, a road cured with calcium chloride can be opened to traffic in one-half the time required if cured by ponding or by earth and water.

**Patching Concrete Pavements**

The patching of a concrete road may be necessary at some time during its life. No matter how careful a contractor is, a pavement may give way in places, on account of the subgrade, aggregate, drainage, frost action or heavy traffic. In order to effectually patch a concrete road, the broken section must be removed completely and the slab broken around the break to a point where the subgrade and slab are again perfect. The broken concrete should be thoroughly cleaned out and cut back so that the patch will readily key into the concrete, and then ready-mixed concrete to which calcium chloride has been added is brought from the central mixing plant to the point at which it is to be used.

After a sufficient amount of concrete has been poured into the hole, it is finished and covered with calcium chloride, and in 48 hours the patch has obtained sufficient strength to permit the removal of obstructions. The amount of calcium chloride required for this work is small, but the saving to the county or the contractor in preventing broken lanterns and broken obstructions will more than pay for the material.

A very noticeable example of the effect of calcium chloride when used in connection with patching is that on the Gettysburg Highway. In the fall of 1921, a patch covering about 400 feet of road was laid, using calcium chloride so that the road would be open in time for the Triangle Tour. The road was open to traffic within 10 days, and immediately following, approximately 30,000 vehicles of all types,

HEAVILY LOADED MOTOR TRUCKS MAY PASS OVER NEW CONCRETE PATCHES 48 HOURS AFTER THEY ARE MADE, IF THE PROPER AMOUNT OF CALCIUM CHLORIDE IS USED IN THE MIXING WATER

which composed the Tour, including heavy trucks, tractors and floats, passed over the patched section, without injury to the concrete.

For surface curing the Dow Chemical Company recommends the use of 2 to 2½ pounds of Dowflake calcium chloride per square yard of pavement. In some cases of extremely dry weather, where there is very little humidity, it is advisable to use the extra half-pound per square yard, but under ordinary conditions it has been found that 2 pounds per square yard remaining on the surface for two to three hours will give satisfactory results. The calcium chloride is easily applied to the pavement by pouring the material from the 100-pound moisture-proof sack in windrows on the side of the pavement. Then with a long-handled broom it can be quickly and easily spread over the surface. With a little experience, a workman can tell the number of lineal feet a 100-pound sack will cover on the width of pavement on which he is working. For the first two or three applications the distance can be measured accurately, and afterwards a very close approximation can be made. In a few hours it will be found that the calcium chloride has taken up enough moisture from the air to dissolve itself, and if an even distribution has been made, the solution will cover the pavement uniformly. If, however, the solution appears in patches with dry places between, it is evident that even distribution has not been made. In this case these patches should be brushed with a broom so that the solution will cover the entire surface.

### Cold Weather Construction

The difficulty of cold-weather construction comes from the fact that the reaction between the cement and the water with which it is gaged is so slow that in weather that is at all below 32 degrees Fahrenheit the water will freeze before the concrete has attained more than a small fraction of its ultimate strength. What further aggravates this condition is that this reaction between water and cement, very slow at ordinary temperatures, is slowed up many times when the temperature gets below freezing, so that a portland cement concrete, if exposed to cold weather conditions, may attain only 5 to 10 per cent of the strength that it would have reached had it been kept at ordinary temperatures for the same length of time. According to the "Concrete Engineers' Hand book," by Hool and Johnson, concrete at 40 degrees Fahrenheit requires four times as long a period to attain a given strength as the same concrete at 50 degrees Fahrenheit, and at 40 degrees Fahrenheit about ten times as long as at 70 degrees Fahrenheit. Below 40 degrees Fahrenheit, the time-strength ratio still further increases.

Many methods of overcoming this condition have been attempted from time to time. These methods can in general be classified under two headings: first, the supplying of artificial heat; second, the application of calcium chloride to the mix. The supplying of artificial heat would be comparatively safe if the personal equation could be eliminated, but on ordinary jobs the temperature control is not adequate and fires will go out unless the firemen and watchmen are thoroughly reliable; or a sudden drop in temperature may occur, against which the artificial heating methods furnished are not adequate protection. As a matter of fact, one error of this kind may ruin thousands of dollars' worth of construction. Further, this type of construction can be used only on work of such types as to make heating a practical proposition, and then in order for the contractor to be sure that proper precaution has been taken, recording thermometers should be used.

The other means of protection, the addition of calcium chloride, has a definite value in connection with all concrete construction during freezing weather. By adding calcium chloride to the water with which the concrete is gaged, increased protection may be had at low cost for cold-weather construction. Experiments have shown that any amount from 2 to 6 per cent can be added, to decided advantage, depending upon the degree of insurance desired. By adding 6 per cent calcium chloride to each sack of portland cement, concrete may be kept from freezing at 20 degrees Fahrenheit. It should be understood that 20 degrees Fahrenheit refers to the temperature of the mass rather than of the atmosphere, and when hot water and hot aggregate are used, the atmospheric temperature can be about as low as will permit men to work out of doors and the concrete mass itself not fall below 20 degrees Fahrenheit. The addition of calcium chloride to the mix gives a greater strength in less time than any other method.

## Iron Ore Used in Louisiana Roads

IRON ore, found in northwestern Louisiana, has proved of great value in road building in that state, and, in some localities where it has been used, has effected a saving of $2,000 to $3,000 a mile in the cost of construction. Highway engineers in Louisiana have been using the ore as a binder instead of sand clay and have found it far superior to that material in many instances. During 1922 the Louisiana State Highway Department completed 350 miles of new roads. Most of this mileage consists of gravel. The remainder consists of roads built of shells, sheet asphalt or bitulithic. The 1923 program includes a larger amount of asphaltic construction.

Iron ore was first used in De Soto Parish, La., in 1917. Then a large deposit was found northwest of Arcadia. Ore from this deposit is being used as a base course on the new Homer-Minden Highway, the Arcadia-Natchitoches Highway, the Ruston-Arkansas Highway, and the Pershing Highway. The state pays about 10 cents a yard in royalties for this material against $1 a yard on sand clay gravel. The saving effected amounts to about $1.50 a yard.

# Band-Saw Makes Big Returns to Contractors

## It Saves Twenty-Seven Cents a Cut on Large Timbers and Speeds Up Much of the Smaller Work

**By O. H. Kneen**
**Engineer, Seattle, Wash.**

MANY contractors, even those rated as among the "big fish," shy at investing money in machine tools like band-saws. Are they always justified in retaining "armstrong" methods? On the majority of the jobs under way, for example, we still see two husky and well-paid men drawing the cross-cut saw through the big timbers, with perhaps a quarter- or half-inch variation from true, when they finally complete the cut.

It is well enough known that the power-driven hand-saw, with two or three roller-top horses to carry the timbers, can saw 12-inch timber in a minute. It takes the two men, sawing by hand, from ten to fifteen or more minutes to make the cut, depending on the accessibility of the timber and its condition, the sharpness and the set of the saw, and the speed of the men. It is unreasonable to say that fifteen minutes per cut can be saved by use of the power-saw, with advantages of smoother cut and one true to square or any angle laid out. This saving would be made in spite of any possible extra time required for handling the timber, as compared with hand sawing.

**The rapid tendency of all modern production is toward replacement of man's labor by mechanical labor, with men to direct the machines instead of "bulling" the work themselves. To the credit of the contractor, he is joining in this procession, and the more he seeks to find how he can supplant man power by machinery at a saving, the more profitable will be his business and the larger his operations.**

Assuming that the contractor accepts these advantages in speed and accuracy, is he justified in investing in such a piece of labor-saving equipment? At first glance, with prices of the best band-saws around $2,000 in the far West, it seems entirely out of the question. Looking further, however, we find that there are still some of the war-time band-saws available, suitable for timbers up to 12 inches square, or even larger, for about $400. Also, there is a lighter type, made for general use, with sufficient capacity for all ordinary contracting work, for about $350. Let us assume a new cost of $400.

The life of such a machine may be taken as ten years, under the adverse conditions of contracting use. Mr. Contractor must loan $400 from his funds, if he has any, and should receive compound interest on his investment for ten years to make it worth his while to invest at all. From the tables we find that at 8 per cent he should receive $800 in ten years from the savings effected by using the band-saw.

Will the use of the band-saw save this amount on average work? Take the estimate of fifteen minutes for two men to make a cut by hand. At 75 cents an hour each, this amounts to 37 cents. Allowing three minutes for a machine cut, a liberal estimate, the labor will cost 7½ cents. The power, from a 10-horse-power motor at a 4-cent rate, that usually applying to contractors' work, amounts to 1½ cents. Allow 1 cent for all other expense of the machine cut.

We have, then, a total cost of 10 cents a cut by machine, as against 37 cents by hand, a saving of 27 cents. This saving must return in ten years $800. If we divide 800 by .27, we find that 3,000 cuts, in the ten years, will save the $800. That is only 300 cuts a year, or an average of one each working day.

It appears that the investment would be amply justified and, in fact, yield far greater returns than any security the contractor would likely purchase. The large amount of cutting done by hand-saws, from concrete form work to inside finishing, a great part of which could be handled by a band-saw conveniently located, was not considered in the analysis. Sometimes it will not pay to transport the piece to the saw, but generally one or more cuts can be made before the wood is taken to its destination, even with smaller material.

It is not often that such ideal conditions as the construction of an army camp can be obtained. At Camp Lewis, for instance, every building was so standardized that all material could be delivered to the building site. The savings thus effected were enormous, and the barracks went up like mushrooms.

For contractors doing a great deal of woodworking, there are various "combinations" which will accomplish almost any operation at a fraction of its hand cost. One company will furnish a "four-in-one combination" which will do circular rip and cross-cutting, bandsawing, jointing, and boring for $196. This almost covers the range of the average wood-working contractors' operations. This band-saw, however, will not take material over 7 inches thick.

ACKNOWLEDGMENT.—From *The American Contractor.*

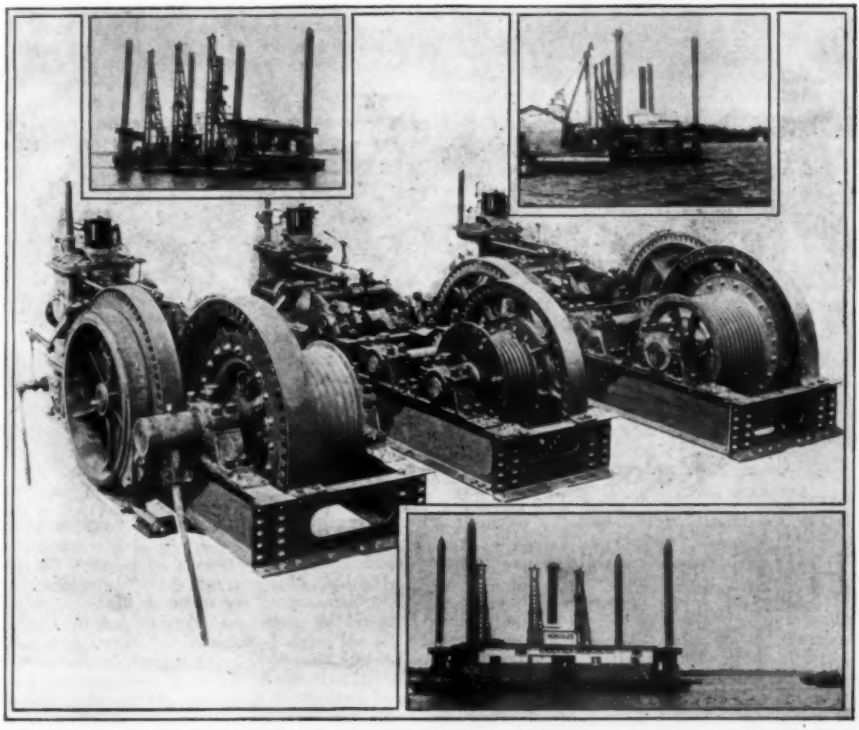
# Blasting a Channel Into Palm Beach

## How the Andersen Dredging Company Is Making a Profit on a Job That Was Advertised for Four Years Before a Satisfactory Bid Was Received

ONE of the most interesting engineering jobs now in progress is the deepening of Lake Worth Inlet, just north of West Palm Beach, Fla. For four years the Lake Worth Inlet Commission advertised this work in the national papers without receiving a satisfactory bid. Finally, however, the Andersen Dredging Company, of West Palm Beach, which is composed of local business men, with A. S. Andersen as President and General Manager, devised a plan that was acceptable, and submitted a figure that permitted the Commission to undertake the project.

In November, 1921, a contract was made between the Commission and the dredging company under which the latter agreed to build all of the necessary equipment for the removal of the rock and to take this equipment in payment at the rate of $5 per cubic yard. As the rock is the hardest that is encountered in Florida and as the current through the inlet runs 5 to 8 miles an hour, with only about 10 minutes slack tide, it is not surprising that most contractors predicted failure at this price. Some of the other bids ran as high as $23, but the Andersen Company has fully demonstrated its ability to make a profit at the price quoted.

The drill boat Hercules, which differs in some respects from the usual type, was designed and built by Mr. Andersen. Owing to variations in the rock formation, it was desirable



**THE DRILL BOAT "HERCULES," OWNED BY THE ANDERSEN DREDGING COMPANY, WEST PALM BEACH, FLA.**

**In the first ten days the drill boat was in service, it blasted out more than 25 per cent of the rock, in the contract for the new channel through a hard subaqueous ledge just off West Palm Beach, Fla. The illustrations show, at the upper left, the boat in position for drilling; upper right, derrick installing the last spud when the boat was being equipped; center, the spud and hoisting equipment, made by the Marion Steam Shovel Company; and bottom, the boat being towed to position**

to vary the spacing of the holes, and this could not be done with stationary drill frames. On the Hercules the drill frames are placed on a carriage and track and can be moved along the side of the boat so that any spacing can be secured. They are of such height that the drills can go 30 feet below the surface. Ingersoll-Rand steam drills are used with flexible steam hose connections. The boat is provided with four spuds, with independent compound-geared hoists made by the Marion Steam Shovel Company, Marion, Ohio. These spuds, 20 inches square and 44 feet long, enable the operators to hoist the barge to a height where it is safe to drill, and the two-drum hoisting engine at each end of the boat supplies ample power to handle it in a swift current. The size of the hull is 70 x 24 x 6 feet. It is equipped with surface condensers, fire-pumps and electric plant.

The Hercules was completed in June, 1922, and the drilling was started while the dredge Edward S. Fowler was under construction. Experienced men on the boat who have worked in all parts of Florida report that some of the rock on the bar is the hardest they have seen. In hard rock the holes are spaced 5 feet by 6 feet and are sunk 4 feet below grade. Nine holes, 3½ inches in diameter, are drilled at one setting and are loaded with about 30 pounds of 60 per cent N. G. dynamite in 2 x 8-inch cartridges, which are slit and pressed tight when the loading tube is removed.

On account of the current, it has been found most practical to insert the tube in the hole as soon as the drill is removed. A water jet is then inserted in the tube, which forces the débris out at the top. When the hole is clean, the dynamite is inserted and pushed home with a loading bar. The wires of the 30-foot waterproof electric blasting caps are fastened to the bar, and then the tube is lifted out of the bar by means of tackle on the drill frames.

With the completion of the dredge, which was designed by the Marion Steam Shovel Company and built by Mr. Andersen, the work started in earnest. The dredge is equipped to make 25 feet of water and has a 1½-yard dipper.

On account of the shallow water across the bar, it was found impossible to dispose of the rock in bottom-dump barges with tugs. The Andersen Company designed and built a barge with a top dump and a capacity of 25 yards. This is equipped with an internal combustion engine and a double-drum hoist, so that it can heave itself to a point in line with the jetties, the excavated rock being used for jetty foundation. Now that a depth of 12 feet has been reached, the rock is disposed of, as in most harbor work, with bottom-dump barges and tugs.

The first contract, which is now practically completed, calls for 20,000 yards. The cut is 150 feet wide and the distance through the outer reef is 750 feet. After the completion of the 12-foot channel, money will be available for the completion of the work to make a depth of 18 feet, and this contract will involve 32,000 yards more.

When this channel is finished, Palm Beach will be open to deep-water transportation to foreign and eastern ports. The Gulf Stream is so close to the coast of Palm Beach that for south-bound ships that hug the coast to avoid the strong current it will be necessary only to go about a mile off the regular course in order to dock. It is claimed that this improvement will bring Palm Beach closer to New York than Jacksonville by water transportation in point of time.

Mr. Andersen, who is in active charge of all the work, has spent 17 years in the dredging business. Practically all of his experience has been with harbor work in South Florida and Cuba. He took part in improving several Cuban harbors and in building terminals for the Florida East Coast Railway at Key West and in establishing the Government Naval Base at the same point.

ACKNOWLEDGMENT.—From *The Explosives Engineer;* photographs by courtesy of Mr. A. S. Andersen and Marion Steam Shovel Company.

# Rules to Prevent Chain Failures

## The National Safety Council Presents a Few Paragraphs Worth Careful Consideration

HOW can chains—especially sling chains—be kept from breaking? What are safe working loads? Is annealing a good thing and how should it be done? After considerable study, the National Safety Council answers these three problems as follows:

1. Before placing a chain in service, either measure carefully its total length, or measure it in sections, say 3 feet long, which should be laid off with punch marks.

2. All chains should be given careful inspection regularly—daily, if in constant service—for cracks or other defects.

3. The length of the chain, or the distance between punch marks, should be checked periodically—at least once in six weeks if in constant service—and the chain should be discarded if it has stretched more than one-third of a link (for average size chains) in 3 feet. The diameter of the metal at the ends of links should be checked to detect excessive wear.

4. Provided these precautions are taken, periodic annealing is of some value as an additional safeguard. There is no recognized standard method of annealing chains, and the desirable temperature may vary according to the kind of chain.

5. Rings and hooks must be of sufficient size and strength; the hook must not be loaded on the point; sudden jerks should be avoided; the load should be hooked onto in a manner not involving unnecessary strain on the chains; and too great an angle between the two parts of a double sling should be guarded against.

# Indictment of War Contractors Without Immediate Trial Is Slander

## Department of Justice Pleads Unpreparedness in Trial of War Contractors After Investigating Cases for Five Years

GENERAL R. C. MARSHALL, JR., of Washington, D. C., who was Chief of the Construction Division of the United States Army during the war, in a talk before the Business Men's Lunch Club in Pittsburgh, Pa., declared that the recent action of the Attorney General in requesting postponement of several cases involving contractors who built cantonments, was a "frank confession of gross mistake" or "ignominous defeat," and scored those men in the Department of Justice "who hold so lightly the power of their high office that they sue and indict indiscriminately in the hope of catching some peccadillos with evidence so insufficient that there is every assurance that their charges cannot even decently be supported. . . . The spectacle of these men [the war camp contractors] pilloried in the public press, posted as evil self-seekers in the time of the Nation's travail, is the result of our fluctuating political power."

Reviewing the events which led to the indictment of various contractors and War Department officials, General Marshall pointed out that many important organizations connected with the construction industry in America had declared their faith in the men indicted and urged a speedy trial; that the plan adopted for letting the contracts under which the camps were constructed was the only plan under which the camps could have been properly constructed in the time required; that the form of contract was one generally employed on commercial work during the war, and under it the contractors who built the war camps received less than 3 per cent gross profit on their work and less than 1 per cent net profit when taxes and other charges not reimbursable were deducted.

With reference to the charges that there was an unconscionable waste of material and labor, he declared that the waste piles of material were worked over until used up and that it was bitter irony that the men who built the camps had to do so at a time when enough skilled workers were impossible to find, and now are accused of fraud because they produced results with the second-, third- and fourth-rate men available.

The testimony upon which the indictments are based, he stated, was given by "hand-picked witnesses," and the basis adopted for a proper cost of the camps was prepared three years afterwards by a Chicago contractor whose omissions and mistakes on cross-examination were so strikingly emphasized as to make him ridiculous. The testimony first issued by the Congressional Investigating Committee, he declared, was completely nullified by the report of a special Board of Review made to the Secretary of War a month before the Congressional Committee reported.

In closing, General Marshall said:

"The history of the world tells that the greatest danger to a people is not so much the attack from without as it is the insidious undermining of the fundamental institutions from within. When enemies attack from without, we can checkmate their efforts by carefully watching with sufficient accuracy to make them of small danger, but when the department on which we rely for such watchfulness shows signs of so conducting its affairs that observant men view its purpose with suspicion, when it is common gossip that its great offices are being used for political capital, it becomes necessary to recognize quickly a more important danger and to counsel for its betterment. I believe there are men and processes actively at work in this great department to-day who, unless restrained, can so discredit the functioning of that organization that the confidence of the people in it will be lost—and confidence once lost is only slowly regained.

"It is time for sober reflection, to take stock, to balance the demands of partisan issues against the stability of proved institutions, and, out of observations taken, make a new declaration of faith and chart a safer course to protect the rights and liberties of American citizens."

**UNSUPPORTED INDICTMENTS FOR POLITICAL PURPOSES ARE INDECENT**

**"After five years, and following investigations and preparations which have cost the Government hundreds of thousands of dollars, the Attorney General has the unmitigated effrontery to plead unpreparedness in cases where he is accusing contractors of inefficiency for having built whole cities in 90 days. Had the contractors performed their work with the same efficiency, they would have deserved to be shot as slackers."**

**—R. S. MARSHALL.**

### Bucyrus Company Moves Chicago Office

The central sales office of the Bucyrus Company, in Chicago, was moved on May 1 to Suite 1015, 134 South La Salle St., Chicago, Ill.

# Clippings for Contractors

## Make Demurrage Work Both Ways

IT'S a poor rule that will not work both ways, and the demurrage rule is not an exception. If you delay unloading a car of materials, or if you hold that car in any way whatsoever, you must pay the railroad a certain sum of money to make up for their loss of use of that car. Demurrage frequently costs you unexpectedly large sums of money on some jobs, and it hurts.

On the other hand, can you collect demurrage from the railroad when your shipments are delayed in transit? What can you do when that load of cement, or sand, or steel, or any other material leaves the shipping point on time but is delayed in transit for several days or weeks beyond the estimated delivery time? Who loses when shipments are thus delayed? When substitute materials must be delivered to your job by truck, the material man, or you, must pay the extra cost of that delivery; the state pays for the wear and tear on the roads; the industry loses the services of the lost material and the lost cars; the railroads lose the use of the wandering equipment; and extra handling charges are incurred.

When confusion exists on the railroads and perishable materials are shipped in gondolas—and sand in box cars—while extra handling charges are again incurred and material is damaged, you are the loser. The railroads pay nothing to offset these losses. Let us have reciprocal demurrage.

—*The American Contractor.*

## Preventing Decay in Wooden Roofs

DECAYING wood roofs need not always be replaced; indeed, it is sometimes cheaper to repair the damaged portion or all of the roof rather than replace it with entirely new construction. The chief cause of decay is dampness. The dampness is caused by condensation on the under-side of the roof due to the colder air outside the building. As well as causing decay and being very annoying, the dripping of this condensed water may cause serious damage to materials and machinery.

At the recent Springfield, Mass., meeting of the American Society of Mechanical Engineers, Wendell S. Brown discussed in detail the question of preservation of wood roofs. Mr. Brown asserts that there are two general groups of fungi which cause decay—the "dry rot" and the "damp rot" or "mill roof" group. The former requires but little moisture, the latter requires a greater amount and grows best at temperatures varying from 35 to 110 deg. F. The damage caused by damp rot is tremendous, and should be more fully realized.

### Insulation

In some cases, says Mr. Brown, it is economical to lay an insulation covered by a felt and slag roofing, and make the necessary repairs, rather than to lay an entirely new roof. The purpose of the insulation is to prevent the condensation of water on the under-side of the roof. It is the moisture from this condensation that assists in the fungus causing damp rot. He cites one instance in which the insulation consisted of 7/8-inch cresoted yellow pine laid on 7/8-inch creosoted furring pieces. The insulating lumber was creosoted on the job at a cost of $0.022 per board foot, and laid at an additional cost of $0.02 per foot. As well as removing the cause of damp rot and of dripping water, insulation causes a large saving in fuel used for heating, and this saving must be considered in estimating the cost of any given roof repairs.

Roof repairs will probably cause less serious interruption to production than roof replacement. Considering the ultimate cost, the maintenance of production is often of greater weight than pure building economies. Mr. Brown cites a particular case, and gives the estimated costs, to show that if the insulation added 5 years to the life of the roof, the 20-year cost would be less than either repairing without insulation or building a new and durble roof, and would hence be justified from an economic view-point. In this estimate he considers cost of repairs, cost of insulation, cost of roofing, cost of new and durable roof, interest, depreciation and the saving of fuel.

—*Canadian Engineer.*

## The Treatment of Sapwood with Preservative

SAPWOOD, as a rule, takes preservative treatment better than heartwood. It seasons faster, but, when green, usually contains a larger percentage of moisture, which often makes it heavier. Because sapwood is the outer portion of the tree, it contains fewer common defects, such as knots, shakes and pitch streaks. In timbers to be given a preservative treatment, a maximum amount of sapwood is preferable. In over 300,000 tests made by the Forest Products Laboratory, no effect on the mechanical properties of wood due to the change from sapwood to heartwood has ever been noticed.—*Wood Preserving News.*

**Lost Time Is Expensive on Construction Work—Help Eliminate Waste Time.**

# Road Construction with a Diesel Oil Dragline

## California Contractor Handles a Fill Along the Pacific Coast with Remarkably Low Fuel Cost

A ROAD construction job that involves a somewhat different class of work than is usually encountered in highway construction is being pushed to completion by Oscar and Eugene Schelling, contractors, of Los Angeles, Calif., on a state highway contract. The work consists of 1¼ miles of a section of highway which is to be built between Long Beach and Seal Beach, Calif. The complete contract was let to H. H. Peterson of San Diego, who is doing the concrete work himself and letting the earth-moving work to Messrs. Schelling.

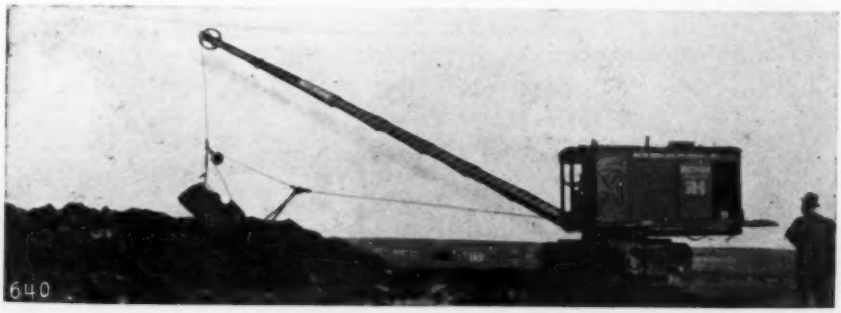
The 1¼ miles of road work involves about 70,000 cubic yards of excavation and consists of making a fill across flat ground along the shore of the ocean. This fill varies somewhat on account of the character of the material and the amount of water in the ground, but in general it is 40 feet wide on top, with a 2 to 1 slope at the sides and a height of about 5 to 9 feet. A Bucyrus 30-B oil dragline with a 40-foot boom and a 1-cubic-yard bucket is being used on this job. The machine is equipped with a 55-horse-power mechanical injection oil engine of the Diesel type.

### Method of Operation

The method of operation is to borrow material from along the location of the fill and deposit it to form a half-section of the road. The machine is then moved to the other side of the projected road, and material is borrowed from the opposite side to complete the remaining half-section of fill.

The difficulties encountered in excavation are considerably more than on the average contract. First of all, the work being along the ocean shore, there is much water to contend with. At high tide the caterpillars of the shovel are frequently under water, making it advisable for the machine to work on mats. It has been found, furthermore, that because of the condition of the ground, the fill has shown a tendency to settle. In such instances dry material is placed at the outside foot of the slope in order to hold the fill, and the more saturated material is cast in the center. This, of course, requires careful operation.

THIS INDICATES THE HEAVY, STICKY CHARACTER OF THE MATERIAL




OSCAR SCHELLING'S DIESEL-OPERATED DRAGLINE EXCAVATOR DIGGING IN SOFT MUD

An added drag on the speed of operation is caused by the character of the material, which consists of a few feet of sticky blue clay, below which is hard-pan. This material fills the bucket easily and gives the machine a maximum load on each swing. The clay has a tendency on parts of the work to cling to the bucket, making it difficult to dump. In spite of these conditions, the 30-B Diesel-engine-operated dragline has given a very good account of itself, and the owners are well pleased with its performance.

The official estimate of pay yardage does not give a correct figure of the actual amount of material moved by the machine, because of the character of the material, a considerable percentage of the yardage of which cannot be classed as pay material. Between January 15 and February 1, 1923, the pay yardage amounted to 8,563 cubic yards. However, up to the date of writing, the work had been about half completed in spite of this added yardage. The machine is working in two shifts.

The Diesel engine feature of the machine is giving excellent satisfaction and resulting in very cheap operation. No accurate figures have been kept of the fuel consumption, but it is believed that the machine is using approximately 2 gallons of fuel oil per hour and about 1 gallon of lubricating oil per shift. This fuel oil is purchased at a price of 4½ cents a gallon, and, including the cost of hauling it by truck to the machine, the price at the dragline is about 7½ to 8 cents a gallon.

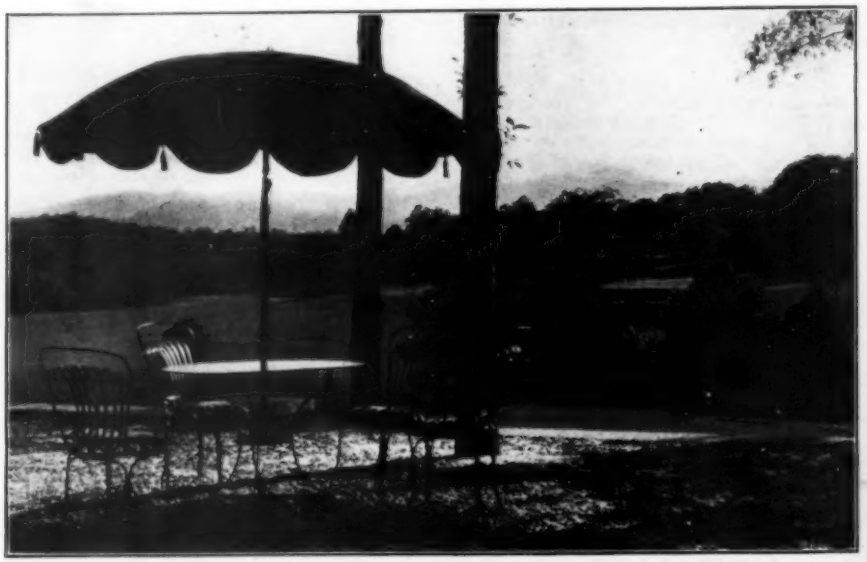
ACKNOWLEDGMENT.—Published by courtesy of the *Excavating Engineer.*

# Solution of the Drainage Problem of the Biltmore Forest Country Club

THE reputation of the golf course of the Biltmore Forest Country Club, built within the confines of the Biltmore Forest, near Asheville, N. C., is scarcely exceeded by that of any other course in the country. No money was spared in laying out this course, a portion of which can be seen from the porch of the club house in the accompanying illustration.

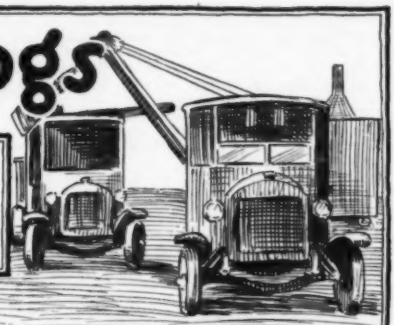
The engineers for the Biltmore Estate Company considered the question of drainage for the fairway of the new golf course from every angle and finally decided upon the use of Newport corrugated metal culvert pipe as the drainage medium to take care of the rainfall, which must be disposed of in such a manner that there will be no washouts in the fairway.

Over 1,200 feet of 48-inch-diameter genuine open-hearth iron corrugated culvert pipe, made by the Newport Culvert Company, 542 West Tenth Street, Newport, Ky., was used in this one installation. A recent inspection shows the culvert to be in excellent condition and giving adequate service without maintenance cost. The strength of corrugated culvert and the rust-resisting qualities of the pure iron copper alloy are the reasons for this excellent service.



**FAIRWAY OF BILTMORE GOLF COURSE AS SEEN FROM CLUB HOUSE**
**This golf course is drained by 1,200 feet of corrugated culvert pipe to maintain the excellence of the course**

# Useful Catalogs



The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

**TWO-BAG CONCRETE MIXERS**

The Atlas 10-S or two-bag concrete mixer, which is capable of heavy work and producing a large yardage, is described in literature which may be secured from the Atlas Engineering Co., 3036 Galena St., Milwaukee, Wis.

**GRAY IRON CASTINGS FOR MANHOLES**

Catalog 9, issued by the William E. Dee Co., 30 N. La Salle St., Chicago, Ill., contains complete listings of reversible manhole curbs, perforated lids and covers, catch-basin covers, storm-water inlets, gutter boxes and coal hole covers.

**SALE OF TANKS, BOILERS, PUMPS, ETC.**

Maxwell, Spiro & Co., 30 Church St., New York City, will be pleased to furnish to contractors a complete list of tanks, boilers, engines, pumps and motors which it is selling from the refuse disposal plant at Barren Island, New York City.

**HIGH-GRADE SEWER PIPE**

Contractors interested in a vitrified sewer pipe made for high sanitary sewer work and for gravity water-supplies will be interested in the 38-page catalog, "Deliverance from Plague," recently issued by the Blackmer & Post Co., Wainwright Bldg., St. Louis, Mo.

**CORRECT BITUMINOUS ROAD TREATMENT**

The Kinney Mfg. Co., 3529 Washington St., Boston, Mass., will be pleased to send contractors complete information regarding its patent combination auto heater and distributor, as well as its handy heater and sprayer, which have solved the problem for heating and supplying various bituminous materials under pressure.

**CONCRETE MIXERS THAT STAND THE STRAIN**

Koehring heavy-duty paving mixers are built to withstand all the strains to which a concrete mixer may be subjected on the job. Literature describing pavers from 7 feet to 32-feet capacity of concrete, operated by steam or gasoline, will be found in catalog P, which may be secured from the Koehring Co., Milwaukee, Wis.

**DIRT-MOVING BY TRACTOR**

The Thirty and Sixty Best tractor, the result of years of continuous improvement in an organization devoted exclusively to tractor production, are described in the new catalog of the C. L. Best Tractor Co., San Leandro, Calif.

**HIGH-GRADE WATER-METERS**

Municipal officials and contractors who are called upon to purchase water-meters will do well to secure the literature of the Badger Meter Mfg. Co., 841-847 30th St., Milwaukee, Wis., describing its frost-proof disc meters.

**ECONOMICAL GASOLINE ENGINES**

The Hercules engine book and price list tells contractors the reason for the remarkable efficiency of Hercules engines for the operation of concrete mixers, saw rigs, air compressors, etc. Get a copy from the Hercules Corp., Engine Div., Dept. B, Evansville, Ind.

**ASPHALT PAVING TOOLS AND EQUIPMENT**

The new 20-page catalog of Littleford Bros., 500 E. Pearl St., Cincinnati, Ohio, is replete with information regarding all types of tar and asphalt and paving tools for contractors.

**PRODUCING A DENSE CONCRETE ROAD**

The Dunn "Once-Over" road finisher, described in Bulletin F-1, issued by the Dunn Road Machinery Co., Conneaut, Ohio, goes over the concrete but once, and therefore is always up with the paver and working on freshly-mixed concrete.

**SEMI-PNEUMATIC TRUCK TIRES**

A Goodrich booklet, "Two Tires in One," which may be secured from the B. F. Goodrich Rubber Co., Akron, Ohio, describes in detail the Goodrich semi-pneumatic truck tire, which fits any standard wheel and which needs no special wheel equipment nor bolts.

**A TRACTOR FOR ROUGH WORK**

The Bates Machine & Tractor Co., Joliet, Ill., has issued a well-illustrated booklet describing the new Bates "40" road tractor, which it claims is particularly adapted to the rough work demanded of a tractor by contractors.

**AN INVESTIGATION OF WATERPROOFING**

The Truscon Laboratories, Detroit, Mich., has issued a very interesting reprint of an article on integral waterproofing, by Samuel R. T. Very, architect, and will send copies free to readers of CONTRACTORS' & ENGINEERS' MONTHLY.

**TOOLS FOR CONTRACTORS' MECHANICS**

In catalog No. 22, issued by the L. S. Starrett Co., Athol, Mass., contractors will find a very complete listing of mechanics' tools for all kinds of work. This catalog is well illustrated and includes a price list.

**OXY-ACETYLENE WELDING OUTFITS**

Bulletin 198-A, issued by the Imperial Brass Mfg. Co., 1200 West Harrison St., Chicago, Ill., describes its various outfits for the use of oxygen and acetylene for welding, cutting, lead-burning and soldering, as well as the Imperial acetylene generator.

**THE BUSINESS END OF THE STEAM SHOVEL**

Contractors contemplating enlarging their dirt-handling equipment will be interested in the two new folders issued by the Thew Shovel Co., Lorain, Ohio, on the business end of the steam shovel and how it is backed up with dependable mechanism in the Thew shovel.

**LOW-COST LOADING**

In Booklet 323, the George Haiss Mfg. Co., Inc., 143d St. and Rider Ave., New York City, describes its truck-loading elevators mounted on Fordson tractors for handling sand, gravel or other loose material in contracting work.

**A FAST-WORKING ELECTRIC HAMMER**

The latest literature of the National Electric Mfg. Co., Chatfield-Woods Bldg., Pittsburgh, Pa., describes in detail the Syntron electric hammer, which plugs into an electric light socket, rapidly sinks a 1-inch hole in hard concrete, and generally cuts drilling costs.

**UP-TO-DATE ROAD CONSTRUCTION**

The illustrated booklets of Warren Bros. Co., 9 Cambridge St., Boston, Mass., describe in detail the construction of Warrenite-Bitulithic pavement and tell of its various advantages.

### A THOROUGH MIX DUMPED QUICKLY

The Jaeger catalog describes the 18 models of speedy, light, simple, thorough-mixing and quick-dumping concrete mixers made by the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio.

### POURING ASPHALT JOINTS WITHOUT LOSS

The new dripless pouring pot, made by the Tarrant Mfg. Co., Saratoga Springs, N. Y., describes in detail the new pouring pot for filling joints in brick and concrete pavements without loss from dripping or leakage.

### ANCIENT BEAUTY FOR MODERN BUILDINGS

This is the title of Catalog 50, issued by the Union Metal Mfg. Co., Canton, Ohio, describing the practical advantages of Union metal columns for modern buildings of all types.

### MAKING A BETTER MOTOR TRUCK

In a well-illustrated specialized book entitled "Making One Thing Better," the Federal Motor Truck Co., Detroit, Mich., describes in detail the building of a Federal truck from individual units made by specialists. This book has much of value to contractors and may be secured by any reader of CONTRACTORS' & ENGINEERS' MONTHLY.

### HALF-BAG MIXERS

The new Smith 375 half-bag tilting mixer, which has a mixed batch capacity of 3¾ cubic feet of 1:3:6 mix, is described in detail in a descriptive leaflet which may be secured from the T. L. Smith Co., 1020 32d St., Milwaukee, Wis.

### TUNNEL FORMS AND CONCRETE MIXERS

The Ransome Concrete Machinery Co., 1772 Second St., Dunellen, N. J., will send to contractors and engineers interested in tunnel forms its literature describing Ransome tunnel forms and Ransome dependable concrete mixers.

### GAS ENGINES FOR CONTRACTORS

Bulletin 22-MC, issued by the Domestic Engine & Pump Co., Shippensburg, Pa., describes dependable "Domestic" power units for the use of contractors, in conjunction with diaphragm and trench force pumps, deep-well pumps, hoists and portable air compressors.

### PILE HAMMER OPERATION

Bulletin No. 28, issued by the McKiernan-Terry Drill Co., 19 Park Row, New York City, describes in detail the operation and uses of its double-acting pile hammers.

### TWO-CYLINDER HOISTS

What is claimed to be the latest in hoisting efficiency and economy is embodied in the Type CJ two-cylinder gasoline hoist, described in the most recent literature of the "O. K." Clutch & Machinery Co., Columbia, Pa.

### PNEUMATIC STONE-WORKING TOOLS

Thos. H. Dallett Co., Broad and Federal Sts., Philadelphia, Pa., has compiled and is distributing its new complete No. 10 catalog, or reference book, of the Dallett line of pneumatic stone-working tools, machinery and supplies for contractors.

### GREATER POWER IN ROAD ROLLERS

Revolutionary changes in the design of the Iroquois macadam roller, described in the literature of the Barber Asphalt Co., Land Title Bldg., Philadelphia, Pa., give greater power and longer life to this steam road roller, described in literature which may be secured free on request.

### MAKING THE CITY FREE OF TYPHOID

The literature of Wallace & Tiernan Co., Inc., Newark, N. J., describes the use of W & T chlorine control apparatus for sterilizing the water-supplies in nearly 3,000 communities in the United States.

### EXPANSION JOINTS FOR CONCRETE WORK

An expansion joint which does not run in hot weather and which is plastic at below-zero temperatures is described in the literature of the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio, telling of Carey Elastite expansion joints.

### "TRACTORS THAT DON'T LAY DOWN"

The performance of "Caterpillar" tractors, made only by the Holt Mfg. Co., Inc., for the use of contractors in every hauling and power need, are described in literature which may be secured gratis.

### HYDRAULIC DUMPING BODIES

A simple, compact, hydraulic hoist that needs little service and will handle any load is made by the Heil Co., 1243 26th Ave., Milwaukee, Wis., and is described in its illustrated literature.

### A COMPLETE LINE OF STEAM HOISTS

In the 17th edition of its general catalog, the J. S. Mundy Hoisting Engine Co., Newark, N. J., describes its complete line of Mundy steam, electric and gasoline hoisting equipment, derricks, cableways, pile drivers, and dredges. It is a remarkable 173-page book, with illustrations and helpful tables.

### HOW TO FIGURE ON WOOD PIPE

Catalog No. 18 recently issued by the Continental Pipe Mfg. Co., Seattle, Wash., is an illustrated text-book which may be secured gratis by contractors interested in the flow of water through all types of wood stave pipe, their capacities and various uses.

### A TWO-IN-ONE TRENCHING MACHINE

The Buckeye trenching machine with the new rotary auxiliary cutter, as well as the features of this machine enabling it to work in crowded quarters, are described in detail in the literature of the Buckeye Traction Ditcher Co., Findley, Ohio.

### CALCIUM CHLORIDE SETS CONCRETE QUICKLY

In a new folder, "Speed Up Concrete Curing," issued by the Semet-Solvay Company, Syracuse, N. Y., is described in detail the use of Solvay free-running calcium chloride for increasing the rapidity of concrete setting, making it possible to open up new roads more quickly.

### HEAVY TRUCKS WITH POWER AND SPEED

The reason that Garford motor trucks are big savers among contractors and engineers for heavy-duty that requires speed and power, is told in the literature of the Garford Motor Truck Co., Lima, Ohio.

### DEPENDABLE GASOLINE ENGINES

The literature of the Novo Engine Co., Lansing, Mich., which is sent free to any interested contractor, tells of the many uses of Novo engines, which are built in single-cylinder types of 1½ horse-power to 4-cylinder engines of 40 horse-power.

### PIPE FOR CONTRACTING WORK

Whether it be for a pressure water-supply or dredge work or sand and gravel production or hydraulic sluicing that a contractor wishes pipe, he will find valuable information in catalog 22-CE recently issued by the American Spiral Pipe Works, W. 14th St. and 48th Ave., Chicago, Ill.

### TRACTORS FOR ROAD WORK

Bear Tractors, Inc., 53 Park Pl., New York City, has just issued an illustrated bulletin describing the Bear tractor and telling why it is the cheapest for hauling road machinery and how it reduces the cost of road building to the contractor.

### ALL-ROUND DIRT-MOVING MACHINES

A description of P. & H. 206 machines for operation as draglines and shovels, together with a complete statement of their versatility and how they have been used by many contractors, may be found in Bulletin 58-X issued by Pawling & Harnischfeger Co., 3819 National Ave., Milwaukee, Wis.

### A ROAD MACHINERY INVESTMENT

The latest catalog of the Good Roads Machinery Co., Inc., Kennett Square, Pa., entitled "Everything for the Road Maker," tells why every piece of road-building equipment made by the company pays for itself in the return it brings to the user.

### A WELL-BUILT TRACTION SHOVEL

The Keystone Driller Co., Beaver Falls, Pa., will be pleased to send its literature describing the Model 4 Keystone traction shovel, which is a versatile machine that can be used as a traction crane and can be equipped with three different kinds of buckets mounted on the boom.

### MAKING HARDER WATER-PROOF CONCRETE FLOORS

The Master Builders Co., Cleveland, Ohio, has issued a particularly valuable illustrated booklet on Colormix, a gaging water dye which hardens, dust-proofs and waterproofs concrete floors. This literature may be secured free on request by interested contractors.

### STEEL ALL-SERVICE TRUCK BODIES

Contractors interested in securing a well-built hand dumping steel body for one-ton trucks, should obtain the folder of the New York Central Iron Works Co., Hagerstown, Md.

### ONE TO 3½-TON TRUCKS

Truck Bulletin No. 10, issued by the Duplex Truck Co., Lansing, Mich., contains illustrations and condensed specifications of 1-, 1½-, 2-, 2½-, and 3½-ton trucks built up specially to stand the demands of contractors.

# Contractors' Equipment for Road Work and Excavation

A SMITH ENGINEERING WORKS CRUSHING AND SCREENING OUTFIT, FURNISHING CRUSHED STONE FOR HIGHWAY CONTRACTOR WHO USES ONEIDA TRUCKS FOR TRANSPORTING IT

A GASOLINE-OPERATED ¾-YARD SHOVEL OWNED BY MASCETTI & HOLLEY, TORRINGTON, CONN.

This Pawling & Harnischfeger full traction-tread ¾-yard shovel was sold through the K. B. Noble Company, Hartford, Conn., to these contractors, who had long been accustomed to steam-operated shovels. The contractors report the shovel faster in operation and more economical to run than any steam shovel they have heretofore used

# Cutting the Cost of Joist Bridging

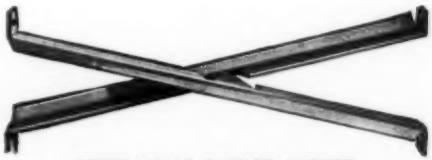
## New Device Made of Steel Replaces Wooden Bridging and Saves Money

A NEW steel joist bridge, made of one piece of metal jointed at the center, has recently been placed on the market by the Steel Joist Bridge Company, Kankakee, Ill. These bridges are put up in bundles of 100, making them easy and convenient to handle, as they are all ready to nail in place, thus eliminating delay and inconvenience.

The bridge requires four nails in place of the eight or more usually required for wood bridges, and since they are all ready for application, it leaves carpenters free to work on some other operation more profitable than cutting bridging, which is quite an item in these times when skilled help is scarce and expensive. These bridges are neat and have very little space for dust and dirt to accumulate.

Since the bridges are made of steel, they are always tight and they do not dry out, warp, or split. Figures selected as an average from the cost sheets of a number of large contractors in widely separated territories show considerable savings in the use of steel bridging. The following figures are based on lumber at $40 and labor at $1. The saving in a small building using only 300 steel braces is $21; in a large building where 3,000 of them might be used, the saving is $210.

BUNDLE OF JOIST BRIDGES, SHOWING COMPACTNESS FOR SHIPPING



STEEL JOIST BRIDGE OPENED

The steel joist bridges are made in two sizes for joists 12 inches on centers and 16 inches on centers, in two gages of steel. The No. 18 gage is equal to 2 by 2-inch or 1 by 4-inch lumber, and the 16-gage is equal to 2 by 4-inch or 1 by 8-inch lumber. The joists come packed as illustrated, so that all that is required to make them ready for use is to cut the wire, spread them apart, and turn the ends, as shown in the second illustration.

# Types of Roads Vary with Local Conditions

## Traffic and Local Materials Govern in Choice of Road Surfacing

THE wide variation in types of Federal Aid roads throughout different sections of the country is due to the availability of different materials, to the volume of traffic, and to climatic conditions. Experienced engineers declare that local conditions should in all cases govern the type of roads and that local materials should be used where possible.

In the group of states composed of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut, the 443.1 miles of Federal Aid road completed has been distributed as follows: gravel, 129.9 miles; water-bound macadam, 18.7 miles; asphaltic macadam, 154.4 miles; asphaltic concrete, 66.3 miles; and portland cement, 73.8 miles.

The total mileage of Federal Aid roads completed in each of these states is as follows: Maine, 714 miles; New Hampshire, 120.8 miles; Vermont, 42.7 miles; Massachusetts, 145.9 miles; Rhode Island, 32 miles; and Connecticut, 24.3 miles. In addition, the mileage under construction or completed and on which final payment has not been made, is: Maine, 121 miles; New Hampshire, 29.6 miles; Vermont, 34 miles; Massachusetts, 59.7 miles; Rhode Island, 6.6 miles; and Connecticut, 49.4 miles.

Federal Aid roads of the more enduring types completed in the states of Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma and Texas aggregate: macadam, 316.6 miles; asphaltic roads, 723.9 miles; brick, 36.8 miles; portland cement concrete, 534.7 miles.

### Cunning Is Not Wisdom

I do not care to fool any man; when he discovers I have fooled him, he will do me more harm than my cunning did me good.—E. W. Howe.

# "CATERPILLAR"

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Holt invented the "Caterpillar"* Tractor and established it as a positive success in every part of the globe. The "Caterpillar" Tractor's principles of traction and construction, found in Holt basic patents, were correct from the first. They have stood every conceivable service test.

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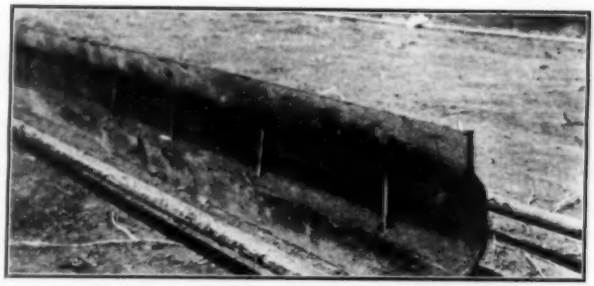
# A Tongue-and-Groove Expansion Joint for Concrete Roads

A TONGUE-AND-GROOVE expansion joint has been developed by the Philip Carey Company, 8 Wayne Avenue, Lockland, Cincinnati, Ohio, to fill the need expressed to this company by numerous road engineers for a longitudinal joint for concrete roads that would prevent the spalling and crushing of concrete at the joint, due to slab movements. Further, the joint, as illustrated, is formed to maintain at all times a water-tight seal, in spite of a possible movement of adjacent slabs. The tongue-and-groove shape gives an interlocking action which holds adjacent slabs to the same surface alignment, thus making it impossible for one slab to be forced up above or to settle beneath its neighbor.



A PRE-FORMED ASPHALT-AND-FELT TONGUE-AND-GROOVE EXPANSION JOINT SUPPORTED BY DOWELS

This Elastite tongue-and-groove expansion joint has been brought out as a direct result of rather extensive experimental installations of the joint made in the summer of 1922 with the assistance of the Illinois State Highway Department. The experimental section is located between Dwight and Gardner, Ill., on the Bloomington-Joliet Road, and is subjected to the heavy traffic between Chicago and St. Louis. The joint has great rigidity and stiffness, even when supported only at its two ends and carrying the ⅜-inch diameter by 15-inch steel pins which are passed through the joint and driven into the subgrade to support the joint material in position.

# Building a Roof on False Work

## Novel Method Used to Hasten Construction When Brick Deliveries Are Delayed

THE Gauger-Korsmo Construction Company, contracting engineers, St. Paul, Minn., general contractors for the construction of the engineering building at the Montana State College, Bozeman, Mont., resorted to an ingenious plan to meet an emergency which arose because of delayed brick shipments. Through the use of false work in building the roof, the completion of the building was hastened by nearly three months. The combined fuel and car shortage, the result of strikes last summer, threatened to seriously interfere with the construction of the building by causing a delay in the shipment of bricks for the load-bearing walls. As time advanced and the remainder of the brick required for the work failed to arrive, with no likelihood of delivery for a considerable period, a suspension of work threatened.

The contractor took up the problem with John T. Turner, Minneapolis, Minn., who had charge of the erection of the steel for the building, and in conjunction with him worked out a solution of the difficulty. About 80 tons of structural steel, manufactured by the Minneapolis Steel & Machinery Company, and comprising the roof trusses for the building, had been delivered on the site. The idea was conceived of erecting this steel on timber false work on top of the concrete slabs and of subsequently bringing the brick work up to the desired height so as to carry the steel and then later remove the false work.

This plan was approved by Professor W. R. Plew, supervising architect, Montana State College, who had designed the structural steel work, and was later approved at the time of erection by Ray G. Church, who was on the job as superintendent of buildings, and was adopted. The work was undertaken according to this plan, and proceeded rapidly without mishap. By the adoption of this plan, a long delay, probably ten or twelve weeks, in the construction of the building was avoided at a relatively small cost. The Engineering Building is a four-story structure with ground dimensions of 189 x 77 feet. It was designed by Fred F. Willson, architect, Bozeman, Mont., and will cost approximately $300,000 when completed.—*The Improvement Bulletin.*

# *Cure new Concrete with* DOWFLAKE

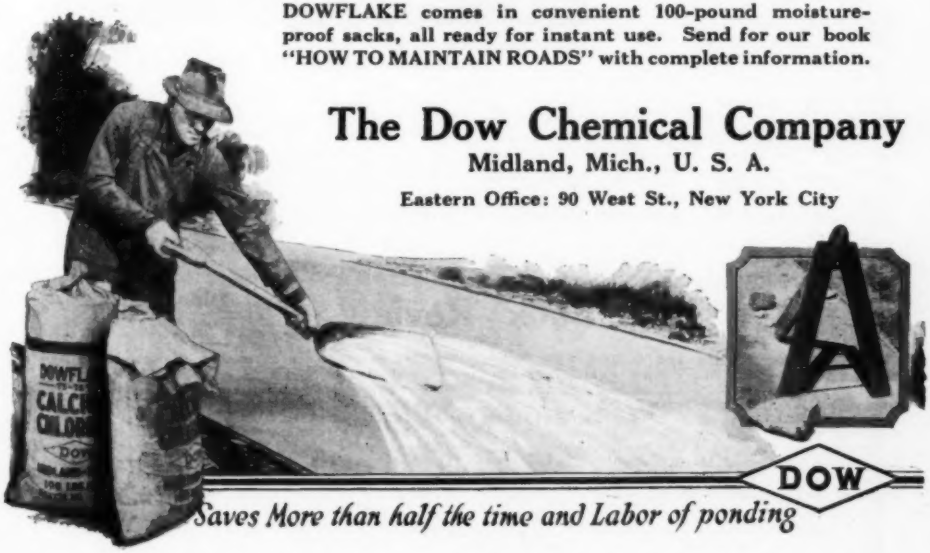
CALCIUM CHLORIDE

**Open Roads Weeks Sooner** — DOWFLAKE hastens the set—saves 15 to 25 days. Forms can be removed quicker—therefore less material is required for them. Saves time to traffic—saves maintenance of detours.

**A Help In Cold Weather** — DOWFLAKE mixed with the concrete also reduces its freezing point. You can start your road work weeks earlier in the spring and keep at it longer in the fall, due to the double action of DOWFLAKE in both reducing the freezing point and hastening the set.

**No More Ponding** — DOWFLAKE spread over the new surface absorbs several times its weight in moisture and holds it in contact with the concrete, where it needed for perfect curing. Quicker and easier to handle and quicker cure than with earth or water. Speeds pavement patching. Patched pavements can be putin use quickly.

**DOWFLAKE comes in convenient 100-pound moisture-proof sacks, all ready for instant use. Send for our book "HOW TO MAINTAIN ROADS" with complete information.**




## The Dow Chemical Company

**Midland, Mich., U. S. A.**

**Eastern Office: 90 West St., New York City**

*Saves More than half the time and Labor of ponding*

# Monorail System for Laying Sewer Pipe

## Electrically Operated Trench Hoist Does Work with Minimum of Trouble

A CONTRACTOR in Hagerstown, Md., is using an electric hoist monorail system for laying sewer pipes. This system, which was designed and erected by the Link Belt Company, Philadelphia, Pa., is claimed to be a most effective method where it is necessary to keep the street comparatively free from obstructions.

The contractor was confronted with narrow streets and the necessity for keeping them free from the usual obstructions that result from the removal of dirt. He therefore employed a system which enabled him to dig his trenches, lay his pipe and cover the completed work progressively. This was accomplished by using the monorail electric hoist system illustrated, the simplicity of which insured his success.

Not only does this system do away with the necessity of obstructing streets and sidewalks with dirt, but it is claimed that it cuts the cost of operation in half, because the dirt is handled once instead of twice. The advance trench is dug, the pipe is laid, and the completed work is covered simultaneously.

CONSTRUCTING SEWER AT SIDE OF STREET WITHOUT HOLDING UP TRAFFIC ON OTHER SIDE

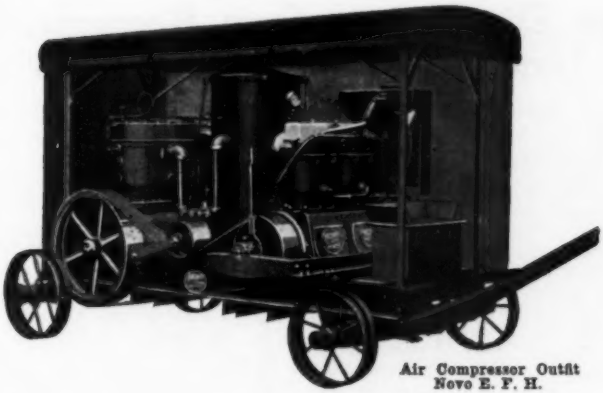
The system, which is assembled in sections, including the trolley, has but one requirement, that of access to electricity. This can usually be had without difficulty. By merely backing a heavy truck against one end, the whole structure is easily and readily moved along the T-rails. This is done as the work progresses. The electric hoist used in this outfit is of the C-2 type, with a capacity of 3,000 pounds, amply capable of caring for the deepest sewer or the heaviest pipe. Because of the low first cost, coupled with the low operating and maintenance expense, this system has been found to be profitable on small as well as large jobs.

---

# Book Review

**Oxy-Acetylene Welding and Cutting.**—By P. F. Willis. The Norman W. Henley Publishing Company, New York. 1923. Sixth revised and enlarged edition. VII + 254 pp. Price $1.50.

This sixth edition of a handy, practical book covering welding and cutting by the use of oxy-acetylene, and devoting a chapter to electric welding, should be studied carefully by every contractor that he may be ready to use a portable welding outfit in any emergency on his job or in his yard. Specific chapters are devoted to the generation and properties of acetylene, the methods of manufacturing and using oxygen, the welding and cutting torch, various types of apparatus and its installation, how to prepare for welding, naming the necessary tools for repair welding, how the welding of different materials is handled, the intricacies of boiler welding and of welding various special pieces. The final chapter of the book is devoted to electric welding and includes tables and useful information.



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Of course you want that Compressor to last. Novo Compressed Air Outfits are noted for their long life, *and for their high resale value.*

Then if that outfit can be turned to do other work it is worth still more to you. If you want to use the engine of the Novo Outfit alone you can do so; operate a crusher; a mixer; a loader; or any other power driven machine.

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# Further Eliminations from Recognized Sizes and Styles of Paving Brick

THE annual meeting of the Permanent Committee on Simplification of Variety and Standards for Vitrified Paving Brick of the Department of Agriculture was held in Washington, March 27, 1923, at which time the report of the variety survey made by the National Paving Brick Manufacturers Association for the years 1921 and 1922 was presented. In considering the further elimination of different varieties, the policy of the Committee to proceed somewhat slowly but surely in elimination, was clearly brought out with a view to avoiding at a future date the necessity of reconsidering an action on account of any possible elimination on the basis of the showing made by any variety in a single year.

In eliminating Hillside re-pressed brick, it was clearly brought out in the discussion that this variety is essentially a special brick made for a special purpose and that it will continue to be made and sold as such. The action of the Committee is not to be construed as in any way reflecting on the desirability and usefulness of Hillside brick and its continued promotion and sale to fill the special demand for it. This brick, measuring 4 by 3½ by 8½ inches, represents only 4.1 per cent of the total production of the paving brick industry. This elimination reduces the recognized sizes and types of paving brick from 7 to 6, the sizes and varieties being shown in the two tables above:

SIZES IN INCHES

| Width as usually laid | Depth as usually laid | Length |
|---|---|---|
| 3½ inches | 4 inches | 8½ inches |
| 4 " | 3 " | 8½ " |
| 3½ " | 3½ " | 8½ " |
| 3½ " | 3 " | 8½ " |

VARIETIES

| | | |
|---|---|---|
| Plain wire-cut brick (vertical fiber lugless) | | |
| 4 inches | 3½ inches | 8½ inches |
| 4 " | 3½ " | 8½ " |
| Wire cut lug brick (Dunn) | | |
| 3½ inches | 3 inches | 8½ inches |
| 3½ " | 3½ " | 8½ " |
| 3½ " | 4 " | 8½ " |
| Re-pressed lug brick | | |
| 3½ inches | 4 inches | 8½ inches |

The committee having charge of this standardization work for the Department of Commerce consists of P. St. John Wilson, U. S. Bureau of Public Works, Department of Agriculture, Washington, D. C.; R. Keith Compton, American Society of Civil Engineers; George F. Fisk, American Society of Municipal Improvements; O. W. Renkert, American Ceramic Society; E. E. Duff, Jr., National Paving Brick Manufacturers Association; Will P. Blair, American Society for Testing Materials; E. W. McCullough, U. S. Chamber of Commerce; P. H. Bates, Bureau of Standards; William A. Durgin, Department of Commerce; Leon C. Herrick, American Association of State Highway Officials; Ross C. Purdy, American Ceramic Society; and E. J. Mehren, Editor, *Engineering News-Record*, Chairman.

# Road Construction in Amoy, China

**By T. M. Elliott**

**Chairman, Kulangsu Municipal Council, Amoy, China**

KULANGSU ISLAND, on which the international settlement of Kulangsu, Amoy, China, is located, has about three miles of shore-line and a population of about 12,000, of which 200 are from western countries. The chief problem at Kulangsu is the construction of roads and keeping them in repair. The roads have only foot traffic—and mostly bare feet at that. The grades are very steep, the rainfall heavy, and the soil a disintegrated granite.

Generally the materials at hand have been used. Clay earth, where it can be secured, is mixed with a little lime and pounded slightly. This soon washes off and requires annual repair. Recently experiments have been conducted, using this as a base and then putting on a thin covering of asphalt or a ¾-inch covering of cement. At present it is believed that the latter is better, though neither has been down long enough to show which will last the longer.

Some day, 25 or 30 years from now, China will be the greatest automobile couuntry in the world. We believe China is going to jump from the narrow path through the fields and across the mountains right over the horseback riding, ox-cart, buggy and carriage, and the railroad eras and land right in the middle of the automobile age. It is wondered whether the world will be ready in those days and what they will mean in engineering and commercial development.

**A responsible contractor is one who offers service, not only in one or two things, but in every possible function comprising the contracting business, including capital, experience, business training, ability to purchase and hire, good judgment, intelligence, self-control, integrity, faith, organization, equipment, and a sense of justice.**

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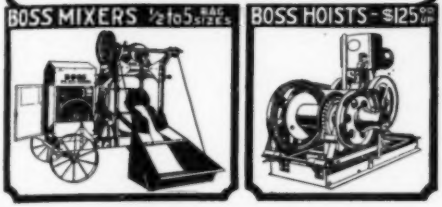

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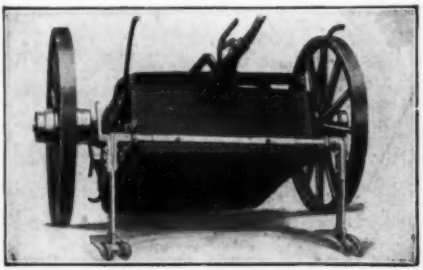

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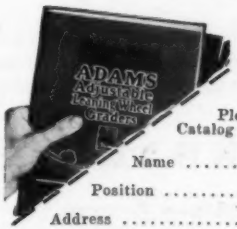


C.E.M. 5

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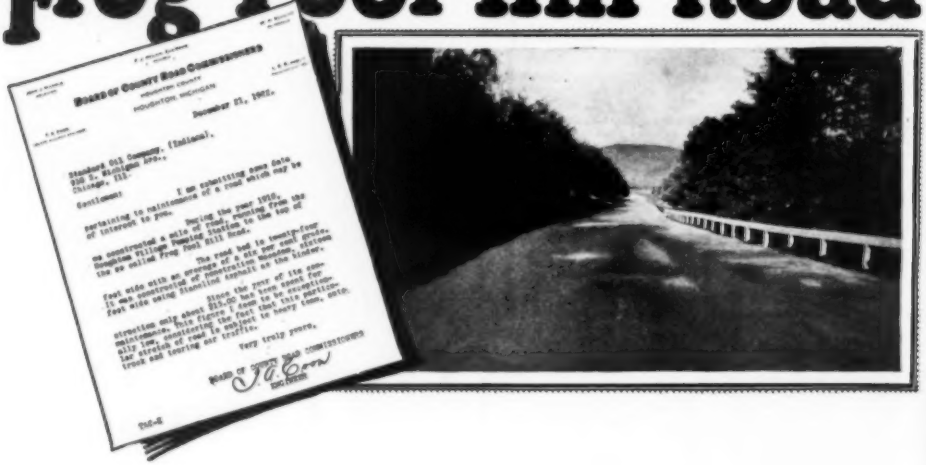
# Frog Pool Hill Road



## $3.75 a Year for Upkeep

EMPHASIZING the low upkeep and durability of roads constructed with Stanolind Paving Asphalt, the above letter is worthy of serious thought by those officials responsible for the paving and maintenance of the roads in their communities.

Frog Pool Hill Road, as Mr. Coon states, is subject to heavy team, truck and automobile traffic, and in addition, to the severe winter climate of Northern Michigan. Yet the above photograph—taken last August, four years after the road was built—clearly indicates that it is still in good condition. And, ***the total maintenance cost of one mile of this road for the entire four years, was around $15.00, an average of only $3.75 a year.***

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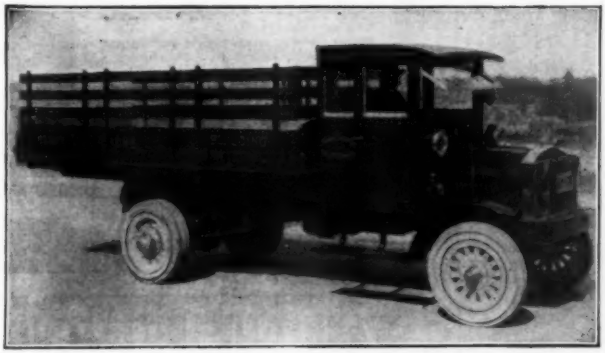

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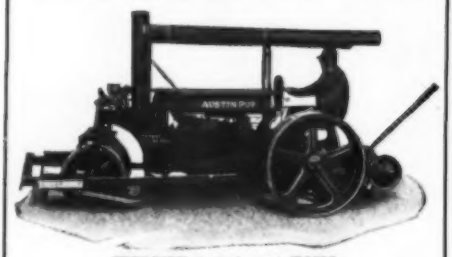

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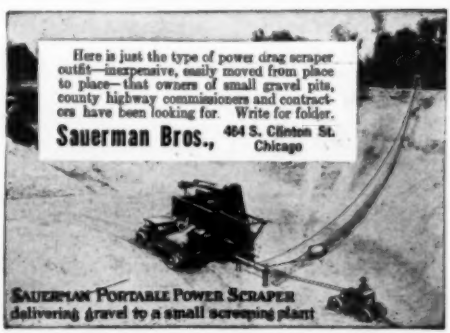
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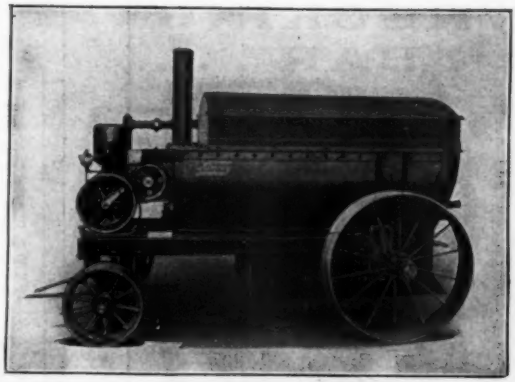

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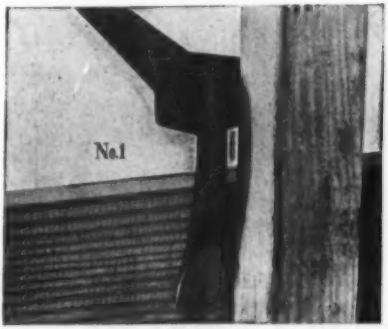


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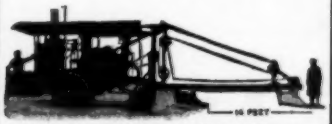

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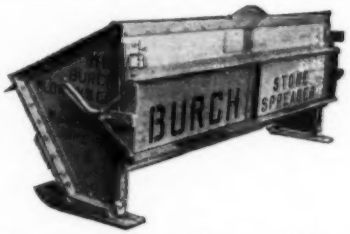


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In the next three or four months real estate, buildings, plants and warehouses, appraised at approximately 110 million dollars already declared surplus by the Secretary of War, will be offered for sale one at a time—either by auction or sealed bid. These properties, developed to keep pace with our War time policy of maximum human and mechanical effort, are scattered hither and yon throughout the United States. Such properties as those following are included in the real estate and plant offerings to be available at early dates:

***Army Base, Norfolk, Va., Piers, Warehouses & Improvements.***
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| WAR DEPARTMENT | SELLING PROGRAM |
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| **May 17th**—Chicago, Ill., Auction. For catalogs write Q.M.S.O., General Intermediate Depot, 1819 West Pe shing Road, Chicago, Ill. | **May 23rd—Ordnance Supplies,** Tullytown, Pa., Auction. For catalogs write C.O., Frankford Arsenal, Philadelphia, Pa. |
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| **May 22nd—Army Supply Base,** Norfolk, Va., Sealed Bids. For specifications & proposals write Quartermaster General, Munitions Bldg, or C.O., Army Supply Base, Norfolk, Va. | **May 28th—Buildings & Improvements,** Ancor, O., Auction. For catalogs write C.O., Q. M. Depot, Jeffersonville, Ind., or A. T. Swepston, Auctioneer, Chillicothe, O. |
| | **The Government reserves the right to reject any or all bids.** |
| **SEND FOR CATALOG** | **SEND FOR CATALOG** |

It behooves industrial executives to give heed to the possibilities these properties offer them, and to watch their respective business publications and the commercial and metropolitan dailies for announcements and sales dates.

Meanwhile there is the matter of industrial equipment and supplies for you to consider. Auction and sealed bid sales in which a lot of such material is usually available, are constantly being held. The sales nearest at hand are listed in the panel on this page. Look over these sales and send for any of the catalogs that interest you as directed in each sales date announcement in the panel. However, it is always the best idea to send your name to Major James L. Frink, Chief, Sales Promotion Section, Room 2515, Munitions Bldg., Washington, D. C., who will see that you will be put on the War Department mailing list for catalogs of all sales in which he thinks you will be interested.

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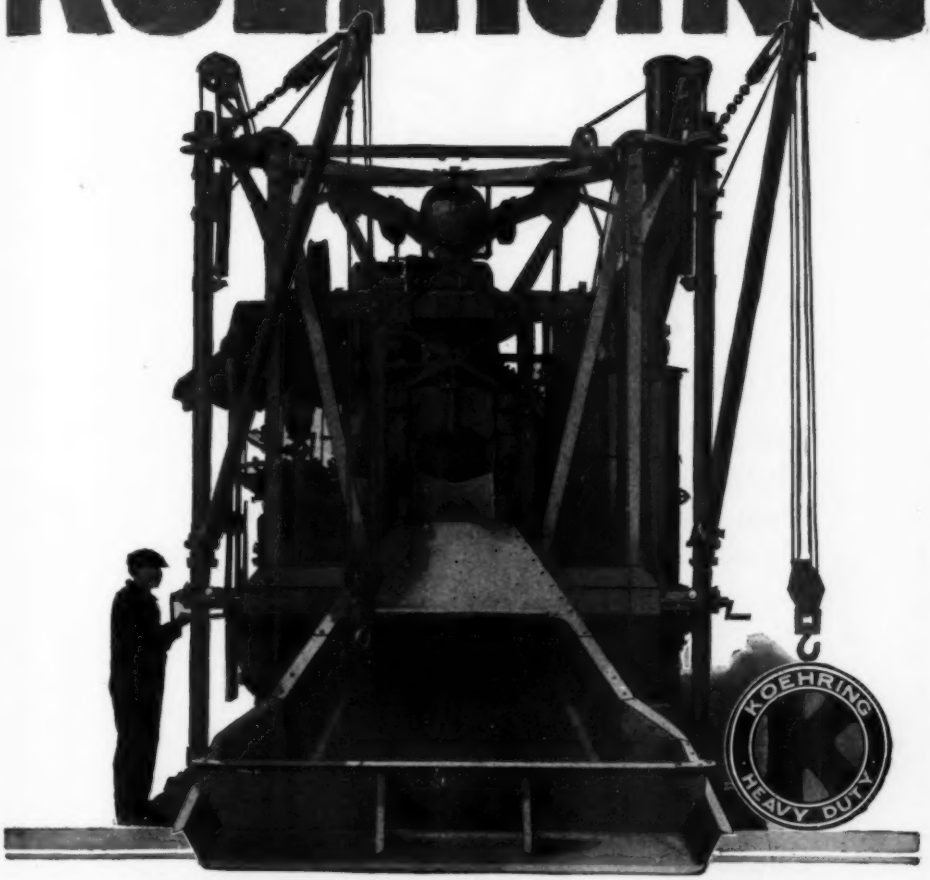


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The Jersey Journal

# CITY REMARKABLY FREE FROM TYPHOID

**In 1922 Death Rate Was Only 1.9 Per 100,000 Population—Expect to make Third or Fourth Place in Whole U. S.**

Jan. 18, 1923—The death rate from typhoid fever in Jersey City last year was only 1.9 per 100,000 population; there were only 18 cases in the city throughout the year and only 6 deaths, said Dr. George McLaughlin, bacteriologist for the Jersey City water supply, today. Dr. McLaughlin received his figures from the report of the State Board of Health, which covers every municipality in the state.

In 1891 the death rate from typhoid in Jersey City was 102 per 100,000 population. This was when Jersey City used the old Passaic River water supply.

In 1919, when so many of the city's young men were away to war, the death rate from typhoid in Jersey City was only 1.5 per 100,000 population. That was the lowest death rate in the history of the city, but the rate of 1.9 per 100,000 in 1922 is very little higher and is really a better showing, Dr. McLaughlin said considering the greatly increased population.

In fact, the figures of this report show that Jersey City stands third or fourth among all the cities of the United States in healthiness, as far as typhoid fever is concerned, **Dr. Laughlin said, and this is due to the purity of the city's present water supply from the Boonton reservoir**

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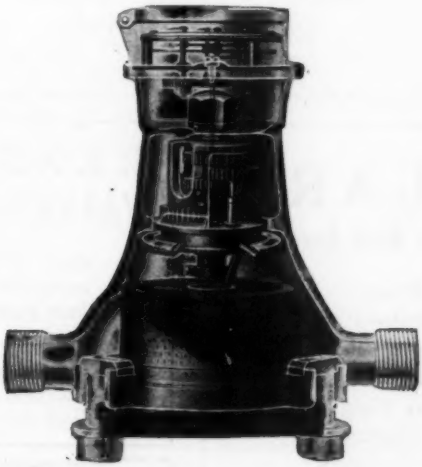

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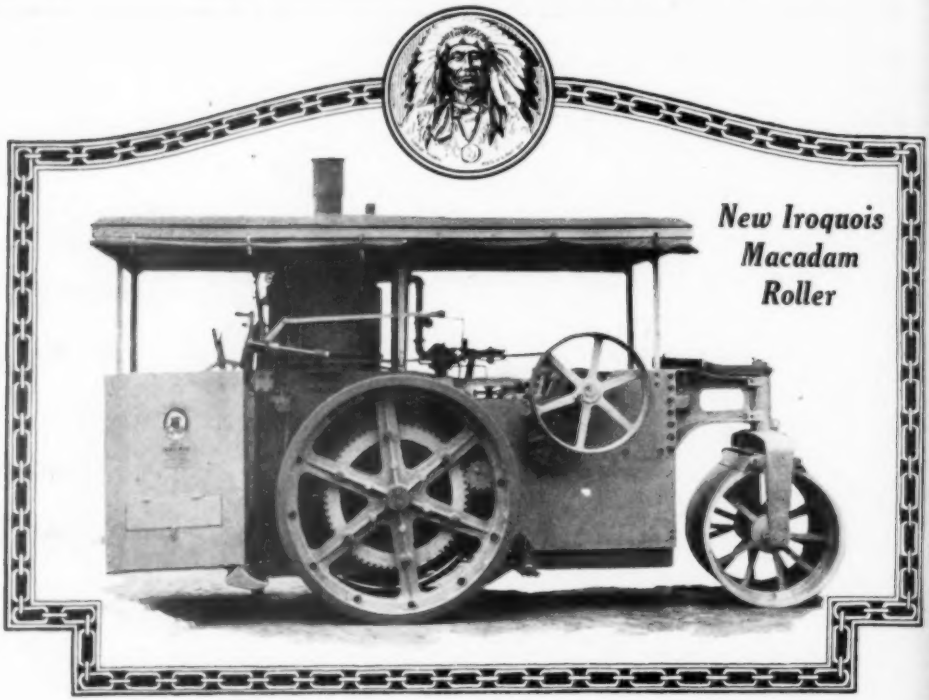
**GENERAL MOTORS TRUCK CO**
***Division of General Motors Corporation***
**Pontiac, Michigan**

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